The UNIDO Indonesia Industry Sector Study (UC/INS/82/106) comprises three volumes:

PROSPECTS FOR INDUSTRIAL DEVELOPMENT AND FOR A CAPITAL GOODS INDUSTRY IN INDONESIA

Volume I : Main Report
Volume II : Prospects for Industrial Development
Volume III : Prospects for a Selected Capital Goods Industry
  Part one : Survey of capital goods and engineering industry
  Part two : Long-term projections of demand for capital goods
  Part three : Capital goods production in developing countries international experience
  Part four : Potential for development of a selected capital goods industry

Volume III : Prospects for a Selected Capital Goods Industry

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EXPLANATORY NOTE

The following abbreviation have been used:

AAC	Annual Allowable Cut
ASEAN	Association of South-east Asian Nations
BKPM	Investment Co-ordinating Board
BPS	Central Bureau of Statistics
CKD	Completely Knock-down (kits)
D.W.	Durbin-Watson Statistics
FFA	Free Fatty Acid
FFB	Fresh Fruit Bunches
GDP	Gross Domestic Product
GEC	General Engineering Contractor
HO	High Off-trend
HT	High Trend
ICOR	Incremental Capital Output Ratio
ISIC	International Standard Industrial Classification of all Economic Activities
LNG	Liquified Natural Gas
LO	Low Off-trend
LT	Low Trend
MDF	Medium-density Fibre Board
MIDC	Metal Industry Development Centre
MO	Medium Off-trend
MVA	Manufacturing Value Added
NDIM	Newly Developed Innovative Machines
NIC	Newly Industrializing Country or Area
OPEC	Organization of Petroleum Exporting Countries
RSS	Rubber Smoked Sheet
SIR	Standard Indonesian Rubber
SITC	Standard International Trade Classification
TCD	Tons of Cane Per Day
UNIDO	United Nations Industrial Development Organization

Part One: Survey of Capital Goods and Engineering Industries

Part One. Survey of Capital Goods and Engineering Industries

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Part One: Survey of Capital Goods and Engineering Industries

Chapter I. An Overview

Capital goods constitute an important part of engineering goods industries classified under ISIC 38 "Fabricated metal products, machinery and equipment". The engineering sector includes five main industrial groups: fabricated metal products (ISIC 381); machinery, except electrical (382); electrical machinery (383); transport equipment (384), and professional scientific and photographic equipment (385). Manufacture of parts and components as well as assembly operations are included in the engineering industry.

Viewed as a group, the engineering industry is one of the most heterogeneous branches within the entire manufacturing sector. It is composed of a wide range of manufactured products, parts and components covering both consumer durables (cutlery, radios, TV-sets, electrical household goods, motor cycles, private passenger cars); intermediate goods (parts and components for assembly operations) and all capital goods (machinery, plant equipment, metal products and some transport equipment).[1] The distinction is important because market conditions and production processes vary widely among products depending upon whether demand is consumer oriented (both household and government consumption) or dependent upon investment demand. Policy approaches to the three product groups may also be quite different.

Indonesian industrial statistics do not permit an exact statistical definition of capital goods. Ideally such definition ought to be based upon ISIC 38, but "sifted" for consumer durables and intermediate goods. A broad estimate however may be derived from the provisional 1980 input-output table, which contains information on the structure of production according to major demand components (Table I.1). The input-output table distinguishes between: inputs into gross fixed capital formation which may serve as an approximation for capital goods; for intermediate output; and for private (household) and government consumption, which may be equated with consumer durables. Based upon Table I.1 an estimate may be derived of the distribution of capital, intermediate and consumer durables within the engineering industries. Accordingly the (weighted) share of capital goods within the engineering goods industry (ISIC 38) is estimated at 28.2 per cent while that of consumer goods is put at 21.5 per cent of total production. Noteworthy is the high share of intermediate goods of 50.3 per cent, primarily consisting of production of materials (such as metal products), semi fabricated products (such as steel rods, wires), components and parts as well as sub-assemblies, sub-contracting and repair. These intermediate goods, in turn, serve as inputs into the capital goods or consumer durable producting industries.

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[1] The distinction between consumer durables and capital goods is by no means always clear, since some products, for example sewing machines, can be either consumer goods (for private use) or capital goods (for use in textile industry).

Table I.1: Component shares of domesticaly produced goods, 1980

ISIC	Sector	Intermed-iate Output	Private consump-tion	Govern-ment consump-tion	Gross fixed capital formation	Change in Stock	Export	Total Produc-tion
			----------Percentage----------					
381	Metal products	71.59	7.78	2.48	18.53	-1.03	0.66	100.0
382,383	Machinery and repair	39.02	11.67	5.93	19.39	15.36	8.73	100.0
384	Transport equipment	33.92	20.28	7.76	37.19	0.69	0.16	100.0
38	Total (excl. 38)	-	-	-	-	-	-	-

Source: Provisional Input-output Table, 1980.

Assuming, that capital goods account for around 28.2 per cent of all engineering goods which in turn account for 17.0 per cent of total manufacturing gross output, it follows that the share of capital goods within the Indonesian manufacturing sector was about 5 per cent of gross output in 1980. While this figure undoubtedly is only indicative, it may be claimed that an "embryonic" capital goods industry has emerged in recent years.

Since an operational statistical definition of the capital goods industry is not feasible, this chapter will initially survey the entire engineering goods industry (ISIC 38) and subsequently place particular emphasis upon those sub-groups which encompass most capital goods, namely, non-electrical machinery and equipment (382), electrical machinery (383) and metal products (ISIC 381). The key focus of the analysis will be on capital goods intended for industrial use, especially plant processing equipment and machinery (ISIC 382). These products are inter alia required for processing raw materials from agriculture and forestry into semi-finished and finished products. Additional information is provided on the iron and steel sector (ISIC 371) which supplies part of an important raw material for the engineering industry.

This broad approach to analysing the capital goods industry is useful since there is a potential for substitution in the product-mix among many sub-groups within the engineering industry. The survey would therefore be indicative of the potential base for development of the capital goods industry in general.

Chapter II. Structure and Performance of Capital Goods and Engineering Industry

Overall performance

The capital goods and engineering industry ranks among the fastest growing industries within the entire Indonesian manufacturing sector. During the period 1970-80 value added of the engineering industry grew at 17.6 per cent annually compared with 11.8 per cent for the whole manufacturing sector. Table II.1 shows that particularly high growth of value added was recorded for electric assembly, which grew at an average annual rate of close to 30 per cent during the 1970s followed by non-electrical machinery (27.6 per cent) and metal products (20.2 per cent). During the same period the number of medium and large scale engineering enterprises grew from 255 to 811 enterprises (Annex Table 4). This rapid growth, which was in part related to the low initial base, but also owed something to favourable developments in the national economy raised the share of engineering goods in total manufacturing value added from 6.1 per cent in 1970 to 16.9 per cent in 1980.

The most important subgroups within the engineering industry in 1980 were transport equipment (6.4 per cent of total manufacturing value added) electrical machinery (5.3 per cent) and metal products (3.5 per cent). The non-electrical machinery industry, which accounted for only 1.6 per cent of total manufacturing value added, has lagged behind in growth of other engineering industries. The production of plant equipment included in this category is still very small. Noteworthy is the small size of the professional and scientific equipment sector (0.1 per cent).

Table II.1: **Value added, employment and labour productivity in capital goods and engineering industries 1970 - 1980**

ISIC	Average annual growth 1970-1980		Share of value added in total manufacturing		Share of Employment in total manufacturing		Value added per employee 1980 (000 US $)	Contribution to overall employment growth of total manufacturing 1970-80
	MVA[a]	Employment	1970	1980	1970	1980		
381 fabricated metal products	20.2	11.5	2.3	3.5	2.8	4.2	2.9	5.7
382 Machinery, except electrical	19.5	10.5	0.4	1.6	0.9	1.2	4.5	1.6
383 Electrical machinery	30.8	27.1	2.5	5.3	0.7	3.9	4.8	7.1
384 Transport equipment	5.6	16.6	0.9	6.4	1.3	3.1	7.3	5.1
385 Scientific and professional equip.	12.0[b]	-	0.0	0.1	0.0	0.1	2.2	2.1
ISIC 38 sub-total	17.6	15.8	6.1	16.9	5.8	12.6	4.7	21.6
Total manufac.	11.8	7.1	100.0	100.0	100.0	100.0	3.5	100.0

Source: Part II, Tables II.4; II.5 and Annex Table 11.

a/ Trend real growth rates based on estimated index numbers for value added for the entire industry as provided by UN Statistical Office, New York.

b/ 1970-1976.

Employment, labour productivity and labour intensity[1]

The contribution of the engineering industry to employment creation has been quite impressive, which is indicative of the labour intensive nature of many of these manufacturing activities. During the priod 1970-80 employment in the large and medium-scale engineering industry grew by 15.8 per cent annually. In absolute terms employment in the enginering industry grew by 93,050 persons from 27,950 in 1970 to 121,000 in 1980, which corresponds to

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[1] Factor intensities in the engineering industry (ISIC 38) are discussed in Part II.

21.6 per cent of the overall increase in employment of the entire manufacturing sector during the 1970s. Concomitantly the share of engineering industries in total manufacturing employment grew from 5.8 per cent in 1970 to 12.6 per cent in 1980. Employment grew substantially in electrical machinery by 27.1 per cent average annual rate of growth from 1970-80, followed by transport equipment (16.6 per cent), metal products (11.5 per cent) and non-electrical machinery (10.5 per cent).

Labour productivity in the engineering industries, especially in the automotive and electrical machinery industries, is generally higher than in the manufacturing sector as a whole. This may be due to the circumstances that many engineering products are sold in protected markets and the fact that productivity in the overall manufacturing sector is somewhat depressed by the low productivity of traditional industries. The highest levels of labour productivity were in the following sub-sectors: motor cycles and three wheel vehicles, motor vehicle manufacture and assembly, electrical apparatus and supplies, and storage batteries (Annex Table 10).

The scanty data available on skill composition of the labour force in the engineering industry suggests that the majority is unskilled. The number of skilled workers, technical and engineering personnel is very small. This lack of skilled labour severely restricts the range of products that can be produced in Indonesia. Skill development is therefore one of the major prerequisites for further development of these industries.

Information on labour intensity provided in Table II.3 shows that the share of wages and salares in value added in the engineering goods industry was 29.2 per cent in 1975. By 1980 the share had fallen to 22.8 per cent and in 1981 even further to 20.0 per cent. This decline was entirely due to a drastic fall in labour intensity in the transport equipment sector from 36 per cent in 1975 to 14 per cent in 1981. In other words there was a substantial increase in capital intensity and/or profit in this sector, particularly in motor vehicle assembly and manufacture, ship building and repair. However labour intensity did not decline in other engineering sectors and remained high particularly in the following sub-groups: kitchen apparatus, transport equipment n.e.c., scientific equipment, dry cell batteries, bicycle, becak assembly and manufacture, metal containers, and motor vehicle body and equipment. (Annex Table 9).

Table II.2 Number of establishments, persons engaged, and average size of establishment, ISIC 271 iron and steel basic industries and ISIC 38 metal products, machinery and equipment, 1975, 1980 and 1981

ISIC		Number of Establishments			Number of Persons Engaged						Number of Persons Per Establishment		
					1975		1980		1981				
		1975	1980	1981	Number	%	Number	%	Number	%	1975	1980	1981
371	Iron and Steel Industries	13	23	22	2,883	-	8,822	-	9,483	-	222	384	431
381	Metal Products	282	363	355	22,434	36.5	41,055	33.8	44,037	33.2	80	113	124
382	Non-electrical Machinery	98	132	128	8,833	14.4	12,055	9.9	12,658	9.6	90	91	99
383	Electrical Machinery	77	113	115	10,463	17.0	37,388	30.8	38,778	29.3	136	331	337
384	Transport Equipment	118	178	188	19,356	31.4	29,991	24.7	35,949	27.1	254	168	207
385	Scientific, Photographic Equipment	15	25	27	460	0.7	990	0.8	1,023	0.8	66	40	38
	Total ISIC 38	590	811	813	61,546	100.0	121,479	100.0	132,445	100.0	104	150	163

Source: Survey of Manufacturing Industries, BPS, Indonesia, 1975, 1980 and 1981.
See also Annex Tables 4 and 5.

Table II.3: Value added, share of wages and salaries in value added and value added per employee, 1975, 1980 and 1981
(values in current prices)

ISIC	Value Added (billion Rp.)						Share of Wages and Salaries in Value Added			Value Added per employee 1981
	1975		1980		1981		1975	1980	1981	
	Value Added	Percentage	Value added	Percentage	Value Added	Percentage				
							---Percentage---			(000 Rp.)
371 Iron and Steel Industries	1.1	-	70.0	-	79.5		32	13	12	8,383
381 Metal products	16.9	26.5	74.2	20.7	85.4	16.1	32	29	33	1,939
382 Non-electrical mach.	8.0	12.6	33.4	9.3	42.9	8.1	24	24	24	3,389
383 Electrical machinery	18.3	28.7	112.6	31.5	125.9	23.6	20	22	23	3,247
384 Transport equipment	20.3	31.9	136.2	38.1	277.8	52.1	36	20	14	7,728
385 Scientific, Photographic equipment	0.2	0.3	1.4	0.4	0.7	0.1	40	26	56	684
Total ISIC 38	63.7	100.0	357.8	100.0	533.0	100.0	29.2	22.8	20.0	4,025

Source: Survey of Manufacturing Industries, BPS, Indonesia, 1975, 1980 and 1981.
See also Annex Tables 1, 2, 3, 6, 7, 8 and 11.

Geographical location

The geographical concentration of engineering enterprises follows the general pattern of the overall manufacturing sector. Table II.4 show that most engineering enterprises, around 86 per cent, are located in Java. Almost one-third of the 790 enterprises in operation in 1981 were located in Jakarta (258 enterprises). Almost one-fourth, or 174 enterprises, were concentrated in East Java, while another 141 enterprises were located in West Java, 95 in Central Java and 11 in Yogyakarta. Outside Java there were a few enterprises in Sumatra (71 enterprises), but in the other regions the incidence of any organised engineering industry is very restricted.

Table II.4: Location of engineering enterprises 1981 (ISIC 38 except 385)

ISIC	Jakarta	East Java	West Java	Central Java	Yogykarta	Sumatra	Sulawesi	Kalimantan	Others	Total
	Number of Enterprises									
381 Fabricated metal products	125	93	45	33	8	34	8	1	8	355
382 Machinery, except elec.	20	30	34	30	1	13	0	0	0	128
383 Electrical machinery	55	10	34	9	1	6	0	0	0	115
384 Transport equipment	58	41	28	23	1	18	5	7	11	192[a]
Total	258	174	141	95	11	71	13	8	19	790

Source: BPS (unpublished data) (Annex Tables 12-17).
a/ Alternative figure reported: Table II.2 (188).

Size structure of enterprises

The average plant size of engineering enterprises has increased from 104 persons per establishment in 1975 to 163 in 1981 (Table II.2). Industrial enterprises are particularly large in the electrical machinery and transport equipment industries especially in the following sub-groups: dry cell batteries, motor cycles, 3 wheel vehicles, radio, TV-sets, communication equipment, motor vehicle assembly and manufacture, and electrical apparatus and supplies (Annex Table 4). These are mainly assembly operations characterised by large production runs, standardised products and economies of scale.

Table II.5 contains additional information on the distribution of engineering output and employment by size class in 1979. The table reveals that small scale and cottage enterprises are important in regard to production of metal furniture, fixtures and in the production of agricultural hand tools, cutlery, screws and bolts, kitchen appartus, metal containers and metal products n.e.c. Undoubtedly many of these small-scale industrial activities provide a breeding ground for entrepreneurial activities and skill development required by medium and large enterprises. Many small industries could enter into foster parent relationships with medium- and large-scale enterprises

Table II.5: Engineering industry; distribution of output and employment by size class of industry, 1979
(output in million Rp.)

Sector Code a/ ISIC	Output				Employment				Share of Small Enter-prises + House-hold and Cottage Enter-prises output	Share of Small Enter-prises + House-hold and Cottage Enter prises Empl.	Size classi-fication b/
	Medium and Large Enterprises	Small Enter-prises	Household and Cottage Enter-prises	Total	Medium and Large Enterprises	Small Enter-prises	Household and Cottage Enter-prises	Total			
		----million Rp.----				----number----			----percentage----		
38111/2/3/4/ 40/90	64,903	13,007	6,928	84,838	21,713	19,820	20,639	62,172	23	65	M
38120	3,165	5,136	3,961	12,262	2,025	4,314	6,400	12,739	74	84	S
38130	116,279	3,019	-	119,298	11,769	2,311	-	14,080	3	16	L
38200/330	129,474	2,761	-	132,235	23,879	3,112	-	26,991	2	12	L
38320	114,537	172	-	114,709	9,379	95	-	9,474	—	1	L
38340	496	10	-	506	204	19	-	223	2	9	L
38311/2	41,457	707	-	42,164	5,677	270	-	5,947	2	5	L
38411	24,046	3,131	1,060	28,237	6,912	2,524	2,042	11,478	15	40	L
	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	-	—	—	L
38430	75,825	1,506	-	77,331	9,706	1,186	-	10,892	2	11	L
38440/50	109,350	1,465	-	110,815	6,655	1,245	-	7,900	1	16	L
	n.a.	n.a.	n.a.	-	n.a.	n.a.	n.a.	-	—	—	M
38500	1,900	1,277	-	3,177	791	912	-	1,703	40	54	M
Total 38	681,432	32,191	11,949	725,572	98,710	35,808	29,081	163,599			

Source: BPS, Industrial Survey, 1974, 1979.
Survey of Small Scale Industries, 1979 (tentative results)
NEI calculations

n.a. = not available.

a/ See explanatory note in Annex.
b/ M = medium enterprises
L = large enterprises
S = small enterprises.

through sub-contracting arrangements, training schemes and thus expand their operations and gradually be upgraded to medium-scale enterprises.

Ownership pattern

Recent data on ownership structure based upon a sample survey of 96 enterprises shows that local non-pribumi enterprise is the predominant ownership form in all engineering industries, particularly in electrical machinery (50.0 per cent of all enterprises), metal products (38.5 per cent), transport equipment (35.7 per cent) and non-electronical machinery (27.3 per cent) (Table II.6).

Table II.6: Establishments by dominant ownership category 1980

Sector	Number of reporting Establishments	Foreign[a/]	Government[b/]	Local Non-Pribumi[c/]	Pribumi[d/]
	---Number---	---------Percentage Share---------			
381 Fabricated metal products, except machinery and equipment	26	23.0	11.6	38.5	26.9
382 Machinery, except electrical	22	22.7	22.7	27.3	27.3
383 Electrical machinery	20	30.0	5.0	50.0	15.0
384 Transport equipment	28	3.6	25.0	35.7	35.7

Source: MANKAP survey, 1980.

a/ "Foreign" if foreign participation in equity is at least 20 per cent.

b/ "Government" if not "Foreign" and if Government participation in equity is at least 20 per cent.

c/ If neither "Foreign" nor "Government" and if equity participation is reported to be predominantly by local non-indigenous persons.

d/ Remaining cases.

The second most important ownership category is pribumi enterprises which play a crucial role in the fields of transport equipment (35.7 per cent), non-electrical machinery (27.3 per cent) and fabricated metal products (26.9 per cent). The role of pribumi enterprises however is limited in electrical machinery.

Most Government enterprises operate in transport equipment and non-electrical machinery industries. In these branches, they account for around one-fourth of all enterprises of the sample surveyed.

Foreign enterprises are important in electrical machinery, metal products and non-electrical machinery. Their share of the number of enterprises in these branches lies between 23 and 30 per cent.

Investment

The proportion of gross fixed capital formation in the manufacturing sector channeled into the engineering industry increased from 8.0 per cent in 1970 to 13.3 per cent in 1980. The data presented in Table II.7 on gross fixed capital information in the engineering industry shows that large investments were channeled into the transport equipment and metal products industry as well as the electrical machinery industry. Investment in the non-electrical machinery industry, which accounted for only 5.9 per cent of gross fixed capital formation in the entire engineering industry in 1980 increased to 13.1 per cent in 1981. The low investment activity in this branch during the second half of the 1970s explains in part the lagging performance of this industry. Major investments have thus been channeled into assembly operations while investments in plant equipment and machinery for processing agricultural products, wood products, textile manufacture, etc. have been very meagre.

Table II.7: Gross fixed capital formation in ISIC 38 metal products, machinery and equipment 1975, 1980, 1981 (million Rp.)

ISIC	1975		1980		1981	
	Million Rp.	%	Million Rp.	%	Million Rp.	%
381 Metal Product	9,190	29.3	20,345	33.7	18,428	23.8
382 Non-electrical machinery	1,338	4.3	3,544	5.9	10,173	13.1
383 Electrical machinery	4,070	13.0	16,015	26.5	24,009	31.0
384 Transport equipment	16,760	53.3	20,341	33.7	24,798	32.0
385 Scientific, Photographic equipment	11	0.1	119	0.2	164	0.2
38 Total ISIC	31,369	100.0	60,364	100.0	77,572	100

Source: Survey of Manufacturing Industries, BPS, Indonesia, 1975, 1980 and 1981.

Considerable foreign investment activity occurred in the metal products industry. The amount of approved foreign investment by the BKPM (Investment Co-ordinating Board) since 1967 was US $711.5 million. However, owing to the often considerable gestation period of some investment and the postponement and/or cancellation of a few large scale projects, only US $512 million (102 projects) were implemented during the same period. This represented 18.0 per cent of all foreign investment implemented in the manufacturing sector (Table II.8).

Table II.8: Approved and implemented foreign investment in the basic metals and metal products sector, 1967-1981

								Total 1967-75	
	1967-75	1976	1977	1978	1979	1980	1981	Value	Projects (Number)
Approved foreign investments million US $									
-basic metals	1,084.9	11.6	18.4	9.9	854.9	...	80.6	2,060.3	23
-metal products	198.8	61.5	72.5	92.0	45.1	98.8	142.8	711.5	126
Implemented foreign investments million US $									
-basic metals	81.1	30.7	27.8	37.8	47.5	23.9	7.9	256.7	19
-metal products	221.0	42.4	35.4	89.9	36.0	52.0	35.3	512.0	102
Implementation ratio (%)									
-basic metals	8	-	-	-	-	-	-	12.5	-
-metal prod.	112	-	-	-	-	-	-	72.0	-
Implemented foreign investment as % of total manufacturing									
-basic metals	5.7	10.2	15.0	14.2	24.7	10.2	3.2	9.0	-
-metal products	15.5	14.1	19.0	33.7	18.8	22.1	14.5	18.0	-
Foreign investment as % of total foreign investment implemented									
-basic metals	3.6	7.2	10.7	9.3	14.9	6.9	2.1	5.8	
-metal prod.	9.7	10.0	13.7	22.2	11.3	15.0	9.3	11.6	

Source: Bank Indonesia, Report for the Financial Year 1981/82.

In the basic metals industry the amount of approved foreign investment was considerably higher, US $2,060 million. However, since a few very large approved projects did not come into fruition the low implementation ratio of 12.5 per cent resulted in only US $256.7 million of implemented foreign investment.

Import dependence[1]

In 1980 Indonesia's imports of machinery and equipment (SITC 7) amounted to US $3,633.8 million which is close to two-fifths of total manufactured imports. Some of the simpler machinery and equipment products are obvious candidates for import substitution provided feasibility studies prove that they are economically viable and can be efficiently produced at or near internationally competitive prices in Indonesia.

Export of machinery and equipment is extremely limited and almost exclusively confined to electronic components. In 1980 exports of electrical machinery amounted to US $108.9 million which corresponds to 3.7 per cent of total manufactured exports.

Domestic demand for machinery and equipment is therefore overwhelmingly met by imports. It is estimated that the share of imports in apparent consumption of machinery and equipment is 66 per cent. Domestic production is almost exclusively oriented towards the domestic market, its share of apparent consumption is estimated at 34 per cent. In 1980 domestic production of the entire engineering industry was 1,159 billion rupiahs which compares with imports in the magnitude of 2,277.5 billion rupiahs.[2] Thus in 1980 Indonesia's imports of machinery and equipment was almost double the value of its domestic production.

Since much of the present engineering production consists of assembly operation, the incidence of import dependence of machinery and equipment is particularly high in regard to intermediate goods viz parts, components and other inputs. In 1980 the share of imported raw materials and components in relation to total raw material requirements of the engineering goods industry was 76.1 per cent. Import dependence was particularly high (above average) in the following sub-groups: storage batteries; dry cell batteries; radio, TV. communication equipment; structural metal products; non-electrical machinery; metal containers; motor vehicle assembly and manufacture (Table II.9).

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[1] Industrial linkages are discussed in Part II of the Industry Sector Study.

[2] Exchange rate conversion US $1 = Rupiah 626.75.

Table II.9: Reliance on imported raw materials, engineering industries, ISIC (38) 1980.

ISIC		Imported Raw Materials and Components as Percent of Total Raw Materials
37100	Iron and Steel Basic Industry	58.0
38111	Agriculture, hand tools	60.0
38112	Cutlery, screws, bolts	20.3
38113	Kitchen apparatus	65.6
38120	Metal furniture and fixture	37.6
38130	Structural metal products	86.6
38140	Metal containers	81.9
38190	Metal products n.e.c.	61.4
38200	Machinery and repair	82.6
38311	Storage batteries	96.1
38312	Dry cell batteries	89.7
38320	Radio, TV, communication equip.	87.9
38330	Elec. apparatur/supplies	75.2
38340	Repair of elec. appl.	18.2
38411	Shipbuilding and repair	45.4
38430	Motor vehicles ass./manu.	81.2
38440	Motor cycle/3 wheel veh.	64.7
38450	Bicycle, becak ass./manu.	49.7
38460	Motor vehicle body + equipment	57.5
38490	Transport equip. n.e.c.	59.2
38500	Manu. of scientific equip.	34.9
38	Metal products, machinery + equipment	76.1

Source: Survey of Industries, BPS, Indonesia, Vol. II, 1980.

Domestic supplies to the engineering goods industry, however, were important for some sub-groups. For example the domestic industry supplied more than half of all raw material requirements in the following sub-groups: repairs of electrical equipment; cutlery screws, bolts; manufacture of professional and scientific equipment; ship-building and repairs; and bicycle and becak assembly and manufacture.

Chapter III. Review of Key Capital Goods Industries

The following review highlights the main features of those engineering goods industries which contain predominantly capital goods for industrial use, particularly non-electrical machinery, as well as electrical machinery and fabricated metal products.

Non-electrical machinery (ISIC 382)

The non-electrical machinery branch consists of the following subgroups: engines and turbines; agricultural machinery and equipment; metal and wood working machinery; special machinery and equipment; office, computing and accounting machinery; and other non-electrical machinery and equipment.

Most capital goods for industrial use are included in the non-electrical machinery branch which is the smallest of the three key industries. In 1981 there were 128 enterprises providing employment for 12,700 implying an average size of 99 employees per enterprise. The branch's share of total manufacturing value added and employment was 1.6 per cent and 1.2 per cent respectively in 1980. Value added and employment grew rapidly at a rate of 19.5 per cent (1970-80) and 10.5 per cent (1970-80) respectively, which is indicative of a very substantial improvement of labour productivity.

The non-electrical machinery branch has lagged behind the growth of other engineering industries from 1975-1980 as reflected in its declining share of employment, output and value added within the engineering industry. There was however a significant increase in investment and value added from 1980-1981. The reasons for the lagging performance can be traced to the meagre investments resources channeled into this branch and the inherent supply problems. Undoubtedly these problems are rooted in lack of skilled labour; insufficient marketing and management skills and inadequate technological capacity to master the highly complex technology involved in producing capital goods. Only very few enterprises have the capability of manufacturing complete parts of products. The quality of products is generally poor and production is greatly dependent upon imports of parts of complete products. These problems have been further compounded by preference for imported capital goods being of superior quality and subject to agressive marketing strategies and credit policies of suppliers in developed countries.

Table III.1 depicts the emergence of an embryonic capital goods industry producing plant equipment and machinery for agricultural processing industries. These capital goods include inter alia sugar cane milling machines, rice press machines, corn grinders, coconut oil milling machines, coffee milling machines, tea processing machines, rice press machines, as well as weaving machines, rubber machines and brick processing machines. However, the extremely low unit value of many items is suspicious and points towards the predominance of assembly operations and/or repair activities, while the actual fabrication of complete products is still limited.

Table III.1: Domestic production and repair of non-electric machinery and equipment (ISIC 382) in Indonesia, 1980

Machinery	Unit	Physical Production	Value (000 Rp.)	Unit Value (000 Rp.)
Generator	unit	58,705	26,369,491	449.2
Radiator	000 units	130	4,231,169	32.6
Stone crusher	ton	102	1,300,500	12,750.0
Generator sets	set	1,645	962,549	585.1
Cranes	unit	37	673,719	18,208.6
Tile press	set	2,578	207,540	80.5
Tile roofing machines	set	206	181,902	883.0
Rice press machines	set	451	175,891	390.0
Tile press machines	set	250	153,000	612.0
Tea processing machines	unit	27	142,598	5,281.4
Mixing machinery	set	37	77,000	2,081.1
Rubber machinery	ton	27	60,937	2,256.9
Sugar cane milling machines	ton	241	58,319	242.0
Brick processing machines	number	1,002	47,600	47.5
Weaving machine apparatus	number	5,205	45,018	8.6
Rubber rollers machines	number	33	35,600	1,078.8
Sondir/special machines	number	24	28,800	1,200.0
Corn grinder mill	number	142	22,120	155.8
Coconut oil milling machines	number	40	21,000	525.0
Brick pressing machine	number	3	17,000	5,666.7
Maize press/roller machines	set	134	16,623	121.8
Tapioca milling machines	set	2	15,000	7,500.0
Moulding machines	number	75	11,250	150.0
Kloss machines	number	15	11,250	750.0
Finishing textile machinery	unit	12	11,100	925.0
Saw machines	unit	1	9,000	9,000.0
Coffee milling	number	33	8,500	257.6
Excenter press machines	number	13	1,500	115.4
Bean curd processing machines	number	7	980	140.0
Chili processing machines	number	2	270	135.0
Other machines	-	-	18,429	-
Total all machines	-	-	34,915,661	-

Source: Survey of Manufacturing Industries, Indonesia, Vol.II, 1980.

Production processes in the non-electrical machinery branch are predominantly assembly activities using imported parts. The incidence of import dependence is relatively strong as reflected in the high share of imports of 82.6 per cent of total raw material requirements (Table II.9). However most intermediate goods from the basic metal industry are from domestic origin (76 per cent) except metal products serving as intermediate goods which are mainly imported with only 9.3 per cent supplied by domestic industries. The predominant use of old machines, simple tools and traditional production technology is characteristic for this branch.

Contrary to most other engineering goods industries, the average size of enterprises in this branch is relatively small, with an average of 99 persons per enterprise, which in Indonesia is at the borderline between medium and large scale enterprises. The majority of the 128 enterprises in 1981 are located in West Java (34 enterprises), followed by East Java (30 enterprises), Central Java (30 enterprises), Jakarta (20 enterprises) and North Sumatra and Riau (13 enterprises) (Annex Table 14). Many of these enterprises were initially established as agricultural supporting repair workshops. In Surabaya and the Probolinggo area in East Java they started as the service basis for the sugar industry; in Tegal, West Java, they developed as centres for supporting rice cultivation; and in the Medan area they originally supported the plantations.

Many of the workshops were originally established by the Dutch. Today the non-electrical machinery enterprises are fairly evenly distributed among pribumi (27.3 per cent of all enterprises) and non-pribumi (27.3 per cent), and between government (22.7 per cent) and foreign ownership (22.7 per cent). A majority of enterprises have the legal status of PT (Perusahaan Terbatas = limited company) while a minority, 14 per cent, have legal status of PD (Perusahaan Dagang).

All products of the non-electrical machinery branch are sold in the domestic market. The virtual absence of exports may be explained by adequate profits in protected home markets (i.e., lack of incentives to look for export markets), lack of international competitiveness (price, quality) and lack of export marketing capacity.

Government banks have so far not played any major role in providing financing for the non-electrical machinery industry. The share of working capital in total capital is high, while the levels of capital utilisation and capital coefficient are low. The non-electrical machinery sector received only a modest degree of protection against competing imports. The effective rate of protection is estimated at 18 per cent (Annex Table 19).[1/]

The potential demand for many non-electrical machinery products is growing rapidly to levels at which economic production in Indonesia may gradually be visualised. Undoubtedly there is widespread preference for purchasing imported equipment, which tends to be cheaper and of better quality. Improvement of product quality, competitiveness and marketing skills is therefore a prerequisite for the further development of this industry, which could also be supported by the procurement policy of public industrial enterprises acting as purchasers of the products of the industry.

The main problems of expanding output of non-electrical machinery are likely to be on the supply side owing to the predominant use of outdated, traditional technology and old equipment. The production of non-electrical products involves higher skills which is greatly lagging. This points to the urgent need for management training and education, on-the-job and vocational training, and special programmes to enhance skill development in general.

Electrical machinery (ISIC 383)

The electrical machinery industry branch consists of enterprises producing: storage batteries; dry cell batteries; radios, TV and communication equipment; electrical apparatus and supplies, as well as repair of electrical appliances. The most important sub-sectors are communication equipment and apparatus (3832) and electrical apparatus and supplies (3833) which include such products as radios, TV-sets, recorded casette tapes, and also integrated circuits, transformers, electrical cables, lamps and refrigerators. Obviously many of these products are consumer durables, but there are a large number of potential capital goods products.

The electrical machinery industry has emerged as the fastest growing branch within the entire engineering goods industry. Value added and

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[1/] The effective rates of protection reported here were based on 1975 data that were published in 1979. Unfortunately, no more recent data are available.

employment grew at an average annual rate of 30.8 and 27.1 per cent respectively from 1970-80. Growth in labour productivity was very modest. The branch's share in total manufacturing value added and employment was 5.3 and 3.9 per cent respectively in 1980. The electrical machinery industry provided employment for close to 39,000 persons in 1981 and made the largest absolute contribution of all engineering industries to overall employment growth in manufacturing during the 1970s.

Table III.2 shows that in 1980 there was quite considerable assembly and domestic production of TVs; integrated circuits and parts; cables, wires and rods; dry cell batteries; casette and tape recorders; and radios, transceivers, high equipment (see also Annex Table 18). Obviously many of these products are consumer durables and intermediate goods but an "infant capital goods industry" also exists. Undoubtedly the established production capacity and existing skills represents a potential basis for future inclusion of capital goods in the product mix. Notable among the relatively few capital goods are: sewing machines (110,000 units); transformers (1,863,000 units); exhaust fans (31,000 sets) and electrical tools (533 million Rp.). Some of these also serve as consumer durables. The low level of capital goods production of electrical machinery reflects the technologically more complex production requirements. These products usually require more sophisticated technology than mechanical machinery.

Production processes are in most cases quite up to date. In many cases they consist of assembly operations based upon imported parts for radio and TV sets, or the assembly of completely knocked down kits (CDK-kits), usually using unskilled or semi-skilled labour. Efforts are being made to standardize products and parts in order to speed up the process of increasing the proportion of domestic content.

The majority of the 115 enterprises operating in this branch in 1981 are located in Jakarta (55 enterprises) and West Java (34 enterprises). A few enterprises are located in East Java (10), as well as Central Java and Yogyakarta (10) and Sumatra and Riau (6). These enterprises are typically large scale with an average size of 337 persons, which is double the average size of the Indonesian engineering goods industry. The average size of enterprises in the industry more than doubled since 1975. Enterprises are particularly large scale in sub-sectors producing: dry cell batteries (692

employees per enterprise); radio, TV-sets and communication equipment (448 persons per enterprise); and electrical apparatus and supplies (274 persons per enterprise) (Annex Table 4). The assembly of electronic products entails many labour intensive operations and require large production runs of relatively standardized products.

Table III.2: Domestic production of electric machinery and equipment (ISIC 383), in Indonesia, 1980

	Unit	Physical production	Value (000 Rp.)	Price per unit (Rp.)
1. TV, black and white/coloured	000 units	607	103,141,491	169,920
2. Integrated circuits and panels	000 units	487,745	52,835,488	108
3. Cables, wires and rods	tons	30,172	45,800,899	1,518,000
4. Dry cell Batteries	-	-	38,925,621	-
5. Cassette and tape recorders	000 units	29,091	33,739,484	1,160
6. Radios, transceiver, Hi-Fi	000 units	3,109	21,954,185	7,061
7. Refrigerators	000 units	82	13,248,519	161,567
8. Other cables	000 meters	121,853	11,213,519	92
9. Storage batteries (accummulator), and parts	-	-	9,373,158	-
10. Bulb and tube lamps	000 units	107,753	9,465,528	88
11. Air conditioners	000 units	37	7,985,937	215,836
12. Fans	000 unit	245	5,504,210	22,466
13. Transformers	000 units	1,863	3,826,032	2,053,000
14. Plugs, sockets, switches	000 units	11,870	3,850,878	324
15. BC	tons	1,656	2,919,108	1,763,000
16. Melamine sheets	000 sheets	603	2,413,644	4,003
17. Sewing machines	000 units	110	2,028,843	18,444
18. Trafo TL	000 units	1,929	1,027,385	533
19. PVC wires	tons	216	1,528,099	7,075,000
20. Gas appliances	000 sets	22	886,680	40,304
21. Electric tools	-	-	532,971	-
22. Rice cookers	000 sets	32	463,376	14,480
23. Condensors	000 units	501	422,243	843
24. Others	-	-	14,056,757	-
Total (gross output ISIC 383)	-	-	387,144,415	-

Source: BPS: Survey of Industries, 1980.

The predominant ownership form is non-pribumi (50 per cent of all establishments), followed by foreign ownership (30 per cent). The role of private pribumi and Government is therefore relatively modest. The majority

of firms have the legal status of PT (perusahaan terbatas = limited company). Many establishments in the branch have been accorded special tax facilities.

The electrical machinery industry is the only engineering goods industry which has penetrated export markets with around 14 per cent of its production being exported. Exports of electronic components increased from US $52.3 million in 1981 to US $ 75.6 million in 1982. Export products are mainly integrated electrical circuits produced by domestic branches of foreign owned (US) companies which conduct a bond processing operation i.e., import components and re-export of assembled products back to the US via Singapore and where Indonesian value added represent only about 20 per cent. Transnational corporations have therefore played a significant role in the development of exports in this industry.

Most inputs for the electrical machinery industry originate from other engineering enterprises, mainly metal products (ISIC 381). However, only 8.4 per cent of these inputs originate from domestic sources. The proportion of imported raw materials and components is very high, particularly in regard to input into the production of storage batteries (96.1 per cent); radio, TV-sets and communication equipment (89.7 per cent); as well as electrical apparatus and supplies (87.9 per cent) (Table II.9). Domestic inputs originate mainly from non-metallic mineral products (ISIC 36) (89 per cent) primarily glass bulbs and tubes for lamps.

Investments through branches of foreign banks seem to play a leading role in the provision of finance. Government banks do not provide any significant credit to enterprises of the sector. Domestic machinery products are highly protected against competing imports through high rates of effective protection estimated at 111 per cent (Annex Table 19).

Fabricated metal products (ISIC 381)

A highly heterogeneous group which consists of: agricultural hand tools and equipment: cutlery, screws, and bolts; kitchen apparatus; metal furniture and fixtures; structural metal products; metal containers; and other metal products. The main products are: galvanized corrugated and flat sheets (for roofing purposes); pipes; construction works; and aluminum extruded products.

Other products include machine parts, hand tools, and gas lamps, bars, wire rod, wires, nuts, pipes, and sheets.

In 1981 there were some 355 enterprises employing around 44,000 persons or 4.2 per cent of total manufacturing employment. The corresponding share of value added was 3.5 per cent. Manufacturing value added and employment grew during 1970-80 at an average annual rate of 20.2 per cent and 11.5 per cent respectively, implying a yearly growth rate of labour productivity of 8.7 per cent. The average labour productivity, however, is still very low for all sub-groups of this branch.

The average plant size, 124 persons per enterprise in 1981 has been increasing since 1975. The small scale and cottage industries play an important role in employment and output of metal products, as indicated in Table II.5. The number of persons engaged in small and cottage industries in fabricated metal products in 1979 was 26,445 persons and 27,039 persons respectively which compares with 35,507 persons engaged in medium and large industry.

Most medium and large enterprises are located in Jakarta (125 enterprises) and East Java (93 enterprises), followed by West Java (45), Central Java (33), North Sumatra and Riau (34), Yogyakarta (8) and Sulawesi (8 enterprises).

Almost all fabricated metal products are sold domestically. There are virtually no exports. Backward linkages to the domestic iron and steel industry have not been fully developed. Most inputs, mainly intermediate goods from the basic steel industry, are still imported, except in the case of production of cutlery, screws and bolts as well as metal furniture and fixtures where domestic raw materials predominate (Table II.9). However as far as inputs from the chemical sector (mainly paint) is concerned, almost 50 per cent is from domestic origin.

Production processes in the metal products industry are quite diverse. Some factories use traditional and outdated technology and product quality is often questionable. But there are also some modern plants using new and sophisticated technology. The fabricated metal products branch exhibits a low average level of capital invested per plant, and a low capital intensity.

Non-pribumi ownership is the largest category (38.5 per cent), followed by pribumi enterprises (26.9 per cent); foreign enterprises (23.0 per cent), while Government enterprises are few in numbers (11.6 per cent). A majority have legal status of PT (perusahaan terbatas = limited company). Government banks play an important role in providing capital for this sector and thus have a major influence on decisions concerning this sector. The rates of capital utilization vary widely from 10-20 per cent to 60-70 per cent due to the heterogeneous character of the branch. Fabricated metal products enjoy a relatively high degree of protection against competing imports through high rates of effective protection estimated at 56.6 per cent (Annex Table 19).

Chapter IV. Planned Developments - REPELITA III and IV

Major planned investment prospects

REPELITA IV (1 April 1984 - 31 March 1989) assumes an economic growth (GDP) rate of 5 per cent per annum. Industry is expected to grow at a rate of 9.5 per cent a year while growth of agriculture is put at 3 per cent per annum. The industrial sector will assume a more prominent place in Indonesia's economic structure.

The machinery and basic metals industry will command high priority during REPELITA IV. The planned growth rate for this industry is 17.0 per cent per year and it is expected that 30,000 new employment opportunities will be created. Special attention will be directed towards the development of industries that produce industrial machinery, with the intention that Indonesia will gradually be able to meet her own needs for machinery - including spare parts - in further development of industry.

Industrial development will also be intensified to produce equipment for agriculture, agricultural implements and agricultural processing machinery. REPELITA IV is thus expected to strengthen the important nexus between industry and agriculture. It is in this context that the present study assumes crucial importance by identifying opportunities for domestic production of capital goods required for processing agricultural and forestry resources.

During REPELITA III and REPELITA IV a number of key projects (52) were planned for the basic metals sector, the basic chemical industry sector and the sub-sector multifarious industry. The total investment requirements for these 52 key projects were estimated at US $11,791.28 million. A complete list of these key projects is contained in Annex Table 20.

Among the 52 key projects, 18 projects were planned for the basic metals industry sector with total investment requirements estimated at US $2,226 million. Some of these investment projects were initiated during REPELITA III and will go into operation during the last year of REPELITA III and/or the first years of REPELITA IV, while others are under negotition or still open for negotiation. In early 1983 the Government decided to review the whole public investment programme following the general economic slowdown and the deteriorating balance of payments situation. As a result a number of projects were either postponed, rescheduled, "deferred", or reconsidered.

The original 1982 investment schedule for the basic metals industry, which will no doubt be further reconsidered, includes the following 18 investment projects,[1] some of which have been implemented while others are being negotiated or rescheduled (See also Annex Table 20):

"1. The establishment of a Pellet Factory in Cilegon, West Java, with an investment of approximately US$ 130 million and a production capacity of 3,000,000 tons/year. This project was to commence in 1982 and should be completed in 1984.

2. The establishment of a Slab Factory and a Hot Strip Mill in Cilegon, West Java. The establishment of this project has been realized.

3. The establishment of a Cold Sheet Mill Factory in Cilegon, West Java, with an investment of approximately US $490 million, to produce 500,000 tons/year of cold rolled sheet. This project is being carried out.

4. The establishment of a Tin Plate Factory in Cilegon, West Java, with an investment of approximately US $56.90 million to produce 60,000 up to 100,000 tons/year of tin plate. This project is to start in 1983 and will be completed in 1985.

5. The establishment of a Seamless Pipe Factory, free location with planned investment of approximately US $186.05 million to produce 150,000 tons/year of seamless pipes. This project is to commence in 1983 and should be completed in 1985.

6. The establishment of a Diesel and Petrol Engine Factory in the regions of Java with planned investment of approximately US $448 million, to produce 200,000 units/year of diesel/petrol engines. This project is to be completed in 1984.

7. The establishment of Ship Yards in Jakarta, Surabaya (Java), Ujung Pandang (South Sulawesi) and Palembang (South Sumatra) with an investment of approximately US$ 49.60 million to produce/construct

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[1] Development Program for Basic and Key Industries and Some Ideas on Industrial Development in the Fourth Repelita, Jakarta, April 1982, Ministry of Industry.

new ships: 21,000 BRT and to conduct repair works: 540,000 BRT. This project has commenced in 1981 and should be completed in 1984.

8. The establishment of a Casting Products (Blanks) Factory for Machines in Cilegon, West Java, with an investment of approximately US $90.57 million an the capacity to produce:
   - Gray Iron Castings : 44,000 tons/year
   - Aluminium Alloy Castings : 4,200 tons/year

   This project is to be completed in 1984.
9. The establishment of a Forging Products (Blanks) Factory for Machines in Cilegon, West Java, with an investment of approximately US $74.89 million, and the capacity to produce:
   - Parts, chassis and transmision : 31,000 tons/year

   This project is to be completed in 1984.
10. The establishment of a Machine Tools Factory in Cilegon, West Java, with an investment of approximately US $4 million, and the capacity to produce:
    - lathes : 650 units/year

    This project is to be completed in 1984.
11. The establishment of a Heavy Equipment Factory in the regions of Java with an investment of approximately US $147.22 million and the capacity to produce:
    - Wheel Loaders : 2,980 units/year
    - Crawler Tractors : 700 units/year
    - Exacavators : 100 units/year

    This project is being carried out.
12. The establishment of a Railway Carriage Factory in Madiun, East Java, with an investment of approximately US $96 million, and the capacity to produce:
    - Cargo Carriages : 200 carriages/year
    - Passenger Carriages : 42 carriages/year

    This project has commenced in 1981 and should be completed in 1984.
13. The establishment of a Power Train Factory, Suspension and Steering System for Motor Vehicles in Jakarta or Surabaya, East Java, with an investment of approximately US $38.40 million, and a production capacity of 150,000 units/year. This project was to commence in 1982 and is to be completed in 1985.

14. The establishment of an Engine Factory for Motorcycles in Jakarta or Surabaya, East Java, with an investment of approximately US $16.80 million, and a production capacity of 200,000 units/year. This project was to commence in 1982 and is to be completed in 1985.

15. The establishment of a General Machinery Shop for Manufacturing in Surabaya, East Java, with an investment of approximately US $235 million and capacity to produce:

    - for Sugar Mills : 6,500 tons/year
    - for Palm Oil Factories : 8,000 tons/year
    - for Crumb Rubber Factories : 450,000 tons/year

    This project commenced in 1982 and is to be completed in 1985.

16. The establishment of a Copper Cathode Factory outside Java with an investment of approximately US $130 million and a production capcity of 40,000 tons/year. This project is to be completed in 1985.

17. The establishment of a Factory making Heavy Electrical Machinery and Equipment with an investment of approximately US$ 28 million. The location of this factory is recommended in one of following three locations: Jakarta, Bandung or Surabaya. This project is planned to commence in 1983 and will be completed in 1985.

18. The establishment of a Dies and Mould Factory with an investment of approximately US $5 million. Location of the factory has not been decided. The project was to commence in 1983 and is to be completed in 1985."

Demand and supply balances and Repelita IV development programmes

Capital investment realised during REPELITA I and II through the first and second years of REPELITA III mostly went into production of consumer goods for the domestic market through import substitution. During the third, fourth and fifth years of REPELITA III a series of important projects were launched in inter alia the field of machinery and basic metals industry.

The investment realised in development projects of the basic metals industry from the first through the fourth years (1979/80-1982/83) of the REPELITA III period totalled Rp. 2,263.4 thousand million and US $1,369.7 million. This investment consisted of Rp. 150.2 thousand million non-domestic foreign investment schemes; Rp. 2,113.2 thousand million domestic investment schemes and US $1,369.7 million foreign investment schemes. The investment realised in these projects would result in a significant increase in the sectoral capacity and production.

The Government has formulated programmes for development of national capacity for certain key industrial products. Estimates of demand and supply in terms of capacity, production and domestic demand have been elaborated for a number of important industrial products at the five digit ISIC level for the period 1982/83 - 1986/87. The estimated supply and demand position for engineering products (ISIC 38) are indicated in Annex Table 21. These estimates are based on the above mentioned investments implemented in the basic metals industry during the first four years of REPELITA III.

The programmes for development and utilization of national capacity in selected machinery and basic metals industries including capital goods and engineering industries during Repelita IV is briefly outlined in the following paragraphs (see also Annex Table 21):[1/]

Industrial and factory equipment

The factory machinery and equipment industry has reached a capacity of 60,000 tons per annum. It is capable of producing machinery for palm oil mills, sugar mills, and - to a certain extent - also for cement factories, fertilizer plant, steel industry, petroleum refinery and mining.

Commodities that have been produced locally include, steel construction of various sizes, boilers with a capacity of 20 tons of steam per hour, farm tanks, pumps, silos, etc. The demand in 1989 is estimated to reach 409,000 tons.

[1/] This review is based upon:
- The Development of National Capacity in Industry for 1983-1986 - Summary, Ministry of Industry, Republic of Indonesia, 1983 (unofficial translation)
- Repelita IV (unofficial translation).

The development programme of Repelita IV is aimed at supporting the development of factories processing agricultural products, plantation, basic chemical, basic metal and mining industries. The manufacture of standard machinery and equipments is primarily directed towards machinery most commonly used like boilers, heat exchangers, compressor pumps, blowers, transport equipment, etc. The manufacture of specialised machinery and equipment is geared towards the production of equipment for processing of palm oil, sugar, crumb rubber, coffee, tea, plywood, cement, pulp and paper, fertilizer, timber and metal processing. Workshops for maintenance of machinery will be developed utilizing the existing factory workshops.

Government owned factories such as P.T. Barata ad P.T. Bona Bisma Indra will be rehabilitated so as to enable them to reach a production capacity of 85,000 ton per annum and provide new employment opportunities for about 9,000 persons. Improvement and acceleration of the private sector's capacity and its interlinkages will be promoted through sub-contracting.

Mechanical equipment industry

The mechanical equipment industry in Indonesia began to develop, with activities in machinery reconditioning, and production of certain types of mechanical utensils on a job-order basis. The Government is constructing a lathe plant (in Cilegon) with a capacity of 300 units per annum which would be completed in 1983. Mechanical utensils to an amount of 10,126 units valued US $35.3 million were imported in 1981. The demand in 1989 is estimated (in units) at 5,950 lathes, 6,250 drillers, 9,600 sawing machines, and 1,000 milling machines.

The development of industrial machinery requires not only basic materials such as iron and steel products, but also capital goods like scrap machine, frais machine, lathe, saw doctor machine, cutting machine, rolling machine, etc. Repelita IV is directed at meeting the demand for such machinery particularly for large, downstream, small industries and also for vocational schools and job training centres. The development of a mechanical equipment industry is also directed at improving the structure of industry and at reducing imports. This objective is to be reached by fostering optimum capacity utilization, by strengthening existing industry, and by promoting basic and strategic projects.

Projects to be given priority include scrap machine with 100 units capacity, and expansion of existing industrial capacity such as lathe from 300 units to 1,000 units per annum, frais machine from 250 units to 1,000 units per annum and drilling machines from 1,000 units to 1,500 units per annum.

Agricultural machinery and equipment industry

Agricultural machinery and equipment has been produced locally in considerable quantity, including tractors, water pumps, threshers, polishers, hullers, rice milling units and sprayers. Basically, capacity has been sufficient to meet the domestic demand, such as 10,000 tractors, 2,500 threshers, 6,100 hullers and rice milling 1,570 units per annum.

The demand for agricultural machinery and equipment is steadily increasing. In 1989 demand for tractors is expected to reach 27,000 units, threshers 2,540 units, polishers 83,750 units, hullers 84,881 units and rice milling 30,000 units.

The development of these industries in Repelita IV is directed at meeting the needs for agricultural machinery by expanding capacity, protecting domestic industry and reducing imports of agricultural equipment. Projects which are being promoted include: a large tractor project with a capacity of 2,000 units per annum; expansion and improvement of the rice milling industry; expansion of mini hand tractors; and other agricultural equipments like irregation pumps, sprayers, threshers, hullers, polishers, sicles, etc.

4. Heavy equipments and construction industry

A heavy equipment industry has developed in Indonesia since the period of Repelita I; it involves the production of road rollers (1,140 units per annum capacity), stone crusher (565 units per annum), concete mixers (2,000 units per annum), and asphalt mixing plants (eight units per annum). This industry also include products such as wheel loaders, motor graders, excavators, bulldozers, diesel and petrol engines (non automotive). In particular, the wheel loader, motor grader excavator and bulldozer have low local contents as these industries are still new and their components industry have not yet developed.

The demand for heavy duty equipment is growing at an average rate of 10 per cent per annum and, in 1989, is estimated to reach 726 road rollers, 3,000 bulldozer and 360 wheel loaders. To meet this demand, construction of new plants has commenced under the Foreign Investment Scheme (PMA) with a capacity of 2,290 units per annum as follows:

- bulldozer	: 1,240 units/annum
- excavator	: 450 units/annum
- wheel loader	: 335 units/annum
- motor grader	: 265 units/annum

There are at present six plants for the production of non-stationary diesel motors, with a capacity of 88,664 units per annum. The annual capacity for each type of diesel motor is as follows:

above 20 HP	: 19,264 unit /annum
below 20 HP	: 69,400 units/annum

Demand in 1983/84 is expected to reach 192,000 units.

The development of this industry in Repelita IV is aimed at raising the local content, increasing value added, improving the structure of industry, and accelerating interlinkages with the medium- and small-scale industry. Priority projects include petrol engines (non automotive) with 30 horse powers with a capacity of 50,000 units per annum; and, hydraulic component project.

Electric equipment machinery

The main products of the electric equipment industry in the near future are generators and electric motors. The generator in demand is one of small capacity (2 to 10 KVA) for household purposes, and also of a capacity above 10

KVA for industrial purposes as well as for the development of national electric supply network (for rural areas). The electric motor demanded is particularly one for industry/factory equipment, the demand for which now reaches 220,000 units per annum as against a present national capacity of only about 17,000 units per annum.

The development programme of electric equipment in Repelita IV is primarily directed at meeting requirements for network expansion, the national electricity system, electric machinery energy, and electric equipment for industrial purposes. The products include among others turbine, steam power kettel generator, high voltage isolator, power transformer, high voltage panel, circuit breakers, distribution transformer, medium/low voltage panel, KWH meter, mini circuit breakers, electricity mast, electromotor, and electric home appliances.

It is planned to expand capacity of existing industry in terms of designing and engineering, as well as manufacturing of electric appliances for which requirements are substantial, among others generators for rural electricity development, electromotors for industry and transport equipment, electro instruments and safeguard appliances. Priority will be given to new projects and to capacity expansion of existing industries.

Electronic industry

The development of an electronic industry in Repelita IV is primarily aimed at supporting the expansion of a national telecommunication network, national broadcasting/information programme, electronic equipment for industry in general (EDP/computer), education appliances, and acceleration of export potentials.

The electronic industry includes the production of telephone apparatus, PABX, analog and digital central telephone, teleprinter, telephone centre, data communication centre, HF-SSB, VHF/UHF transceiver, mini satlite, radio broadcast, airbone radar, marine radar, direction finders, micro computers, electronic components, television receiver apparatus, and radio cassettes.

In manufacturing electronic appliances, the role of software appliances is crucial. However, the domestic capacity of software appliances is limited, and relies much on imported design. In order to strengthen the industry, a centre for electronic industry development will be established to provide research facilities for the development of an electronics industry. Attempts will also be initiated to build semi conductor devices and integrated circuits for acceleration of export potentials and for meeting domestic requirements of component technology.

In order to meet the country's need for telecommunication and broadcasting equipments (TV and radio), and to accelerate the export potentials during Repelita IV, attempts will be made to expand the capacity of existing industry.

Motor vehicle industry

The supply of four-wheel vehicles is currently in the hands of 22 Sole Agents/Authorized Dealers covering 20 Assembling Plants which actively produce 31 makes of vehicle consisting of 78 types. The capacity of domestic production of four-wheel vehicles is currently 350,000 units per annum consisting of commercial as well as passenger vehicles. The motor vehicle industry, which in recent years has attracted attention for its performance, has been developed to meet domestic demand, and to encourage the growth of supplier industries.

The procedure governing the use of spare parts for commercial four-wheel motor vehicles is reflected in the Decree issued by the Minister of Industry No. 168 year 1979 which required the use of only locally made spare parts, including engines, not later than the end of 1988. A statement has also been issued authorizing seven assembling establishments to produce motor vehicle engines with a total capacity of 460,000 units per annum.

The development programme of motor vehicle industries in Repelita IV is aimed at meeting the country's need for commercial vehicles by utilizing domestic industrial components. The objective is that by 1986/87 all components of commercial vehicles are to be manufactured in the country. Measures to be taken, in this regard, include maximization of existing capacity and the promotion of key motor vehicle projects, as well as supporting projects such as foundry and forging for manufacturing of machines. Key projects to be developed include a machinery project using fuel and diesel for motor vehicles having a capacity of 425,000 pieces per annum; "power train", suspension and steering system, each having capacity of 360,000 pieces per annum, foundry and forging projects to meet the need of the country's iron casting capacity of 32,600 tons per annum, aluminium casting (3,540 tons per annum) and forge blanks (12,400 tons per annum).

Measures will also be taken to develop component industries such as cabin, rear body, chassis/frame, fuel tank, wheel rim, left spring, muffler and tail pipe, radiator, shock obsorber, regulator and ignition coil.

Railway equipment industry

PT INKA is so far the only industrial establishment in the railway rolling stock industry. It is located in Madium and has been capable of producing railway carriages. The plant commenced production in 1981, assembling imported CKD raw material. The output of this plant mainly goes to the domestic market. Production capacity at present reaches 300 cargo carriages per annum. By the middle of Repelita IV, production capacity is to be increased to 600 cargo carriages and 50 passenger carriages per annum. Electrically Operated Train (KRL) and Diesel Operated Train (KRD) are to be produced early in Repelita V, each with production capacity of 20 units per annum.

The development of the railway industry in Repelita IV is aimed at meeting the country's need for increased transport facilities for industrial products such as cement, fertilizer and asphalt.

Attempts will be made to meet the need for most railway equipments, accessories and components thereby reducing the country's reliance upon imports. To achieve this objective, the development of the railway industry is directed at increasing capacity utilization of existing industry, and developing railway workshops for the maintenance of carriages, rails, etc.

Projects which are to be constructed include pasengers carriages, diesel railways, electric railways and locomotives, as well as acceleration of capacity of commodities carriages.

Aircraft industry

The only industrial establishment in aircraft production is PT Nurtanto Aircraft Industry which is capable of producing various types of aircraft.

The output of this plant is intended not only to meet domestic demand, but also for export to Burma, Pakistan, etc.

The production capacity for the fixed wing aircraft, is 24 units per annum for C-212 type, and 11 units per annum for CN-235 type . Production capacity for rotary wing helicopter, is 36 units per annum for BO-135 type, and 12 units per annum for PUMA type.

Projects which will be given priority in Repelita IV include production of C-212 planes, BO-105 helicopters, Puma helicopters, CN-235 and BK-117 helicopters.

10. Shipbuilding industry

The objective of ship building industry development is to increase the capacity of the industry so as to meet domestic demand, both for new boat construction and for repair. The development of the shipbuilding industry in Repelita IV is aimed at gradually meeting the need of the national shipping fleet. In line with this, attempts will be made to develop industry which will meet the need for shipping equipments and accessories. In this way the country's reliance upon imports could be reduced gradually and it will aslo strengthen th existing structure of industry.

There are at present 82 shipyards for steel boats, 68 for wooden vessels and 1,500 for traditional vessels located in many different places of the country, but with 75 per cent on Java. The capacity is 1,150,000 DWT per annum for repair and 195,000 DWT for new construction.

Repelita IV includes programmes to develop the industry's capability in mastering technology, rehabilitation of existing equipment, and construction of new ship docks. The new ship docks to be constructed are with capacity of up to 10,000 Dwt., divided into the following categories: 501 - 2,000 Dwt (14 ship docks), 2001 - 5,000 Dwt. (9 ship docks), and 5,001 - 10,000 Dwt. (4 ship docks). Concomittantly, facilities for repair of ships will be accelerated up to 30,000 Dwt. Particularly for East Indonesia, the facility at Ujung Pandang shipyard is to be accelerated from 500 Dwt. to 5,000 Dwt. and the facility for repair from 500 Dwt to 7,000 Dwt.

Basic metal industry

a) Iron and steel industry

The capacity of steel bar plants in 1982/83 was 2 million tons, while the production of steel bars was 391,000 tons, meaning a capacity utilization rate of only about 20 per cent. The consumption of steel bars during the same period was 350,500 tons, the excess quantity of 40,500 tons was intended for the export market. The capacity for concrete iron bars production in 1982/83 was 1,200,000 tons, while the production was 745,000 tons, or about 62 per cent of the capacity. The demand for concrete iron bars during the same period was 695,800 tons. The excess production of 49,200 tons was destined for exports.

The development of the iron steel industry in Repelita IV is aimed at meeting the country's need for iron and steel products in order to reduce import and to strengthen the industrial structure. In line with this, attempts will be made to invite invertments in key and strategic projects, and to fully use existing capacity. Key projects to be built include an iron and steel plant (lembaran baja canai dingin) to meet the need of down stream industry, with a capacity of 850,000 tons per annum; a tin plated steel sheet project (lembaran baja lapis timah) to meet the need of tin industry, with capacity of 130,000 tons per annum; and a pump (without wrap) project to meet the country's need for iron pumps, mostly used in oil drilling, with capacity of 160,000 tons per annum. The development programme also includes a large scale steel plant project to meet the need of the construction industry for

buildings and bridges, with a capacity of 10,000 tons per annum, and a steel plant to support the development of a machinery industry. Foundry and forging industries will also be developed to support the development of these industries.

b) Metal industry (non iron and steel)

The aluminium ingot industry of Asahan had commenced production at the end of 1982 with 115,000 tons output, while the capacity per annum was 225,000 tons. The demand for aluminium ingots during the same period was 24,000 tons. The excess production was 91,000 tons.

Additionally, copper rod had also been produced at a capacity of 50,000 tons, while the production in 1982 was 24,000 tons using imported raw material.

The development of the metal industry in Repelita IV is aimed at meeting the domestic needs for metal products, improving the structure of industry, and reducing import dependency. Expansion of capacity of existing industry and promotion of key strategic industries are envisaged. The key projects to be established include: a copper cathode plant to meet the need of the country's copper cathode with capacity of 100,000 tons per annum; aluminium plant to produce aluminium ingot; an aluminium slab plant/project to meet the need of the aluminium sheet industry with a capacity of 40,000 tons per annum; an aluminium wire stem project with capacity of 15,000 tons per annum; an aluminium billet project, with a capacity of 15,000 per annum, an aluminium casting project, needed for the production of engineering products such as motor cycle spare parts, diesel motors, four wheels motor vehicles, ships equipments/accesories, etc. with capacity of 6,000 tons per annum; and expansion of capacity of the wire stem industry from 36,000 tons to 50,000 tons per annum.

Location

The basic metal industry is mainly located in Java and in northern Sumatra, including the aluminum industrial centre in Asahan. The basic metal and metal fabricating industry is concentrated in the Cilegon area (West Java) and to a less extent Jakarta, East Java and north Sumatra.

The factory machinery industry is found in East Java, Jakarta, West Java, Central Java and North Sumatra. Machinery workshops of the basic chemical industrial estates will also be developed into engineering plants.

Electric and professional electronic equipment industries are found in West Java and Jakarta. While ship building is scattered throughout almost all areas of Indonesia, the motor vehicle industry is concentrated in Jakarta area.

Chapter V. Summary of Main Features and Constraints

The salient features of the structure and performance of capital goods and engineering industries may be summarized as follows:

i) The base of the entire capital goods and engineering industry is very narrow both in regard to the number of establishments and the range of products they produce.

ii) An embryonic capital goods industry has emerged in recent years which is estimated to account for around 28.2 per cent of the engineering goods sector, the equivalent of around 5 per cent of the entire manufacturing sector in terms of output.

iii) The number of plant equipment and machinery industry products produced remain small but is increasing; they are mainly used for processing agricultural crops.

iv) The capital goods and engineering industry sectors rank among the fastest growing industries within the entire Indonesian manufacturing sector both in regard to employment, and value added. The high growth rates are in part attributable to the low initial base.

v) Assembly operations using imported parts and components predominate, especially in the electrical machinery and transport equipment industries. While actual production and fabrication of complete industrial products, is limited and confined to a narrow range of products, there is some production of components and parts.

vi) Assembly operations in the transport equipment industry (cars, motorcycles, bicycles) and electrical machinery (radios, TV sets, and various consumer durables) account for a very large part of growth in the engineering industry. These manufacturing activities usually involve unskilled or semi-skilled labour.

vii) There is some indication that the engineering and capital goods industry has become more capital intensive and/or generated more profit since 1975 as reflected in the declining share of wages and salaries in value added, which in 1980 amounted to 20 per cent.

viii) Production of non-electrical machinery, which includes most capital goods, has lagged behind i.e. its share of employment and value added has declined within the engineering industry. Production of capital

goods in this branch involves higher skills, which are in very short supply and their shortage is one of the main impediments for the further development of this sector. Other constraints are rooted in the low of investment levels and the predominant use of outdated technology and old equipment as well as inadequate management and marketing skills.

ix) Most capital goods and engineering industries supply the domestic market, the only exception being electronic equipment where some foreign firms export part of their production.

x) The incidence of import dependence for raw materials is very high; around three-quarters of total material requirements are imported. Backward linkages to the domestic iron and steel industry and linkages within the engineering industry itself have not yet been fully developed.

xi) Most engineering industries, except non-electronic machinery, enjoy high levels of protection against competing imports through high rates of effective protection.

xii) Most engineering enterprises belong to the medium and large scale category. The average plant size has been increasing from 104 persons in 1975 to 163 persons in 1981. However, small enterprises are important in fabricated metal products. Many small enterprises provide a breeding ground for entrepreneurial and skill development and could be expanded and be upgraded to medium scale level through sub-contracting and other arrangements with medium and large enterprises.

xiii) Almost one-third of all engineering enterprises are located in Jakarta, and close to one-fourth in East Java. Nearly to one-fifth are located in West Java. Outside Java there were a few enterprises in Sumatra but in the other regions the incidence of any organised engineering industry is very restricted.

xiv) Considerable investments were channelled into the transport equipment, metal products and electrical machinery industries while investments in the non-electrical machinery and professional scientific equipment industries were sluggish. This partly explains the lagging performance of the latter two branches.

xv) Public enterprises are particularly important in the transport equipment and non-electrical machinery industy, where they account for around one-fourth of all enterprises. Many of these enterprises are very old and in need of rehabilitation and upgrading of their management system and technological base. Their institutional linkages to Government supervisory and control agencies need to be made more business oriented. A complete management review of their operations and decision making procedures would appear to be prerequisite for performance improvement.

xvi) The engineering and capital goods industry will command high priority during REPELITA IV. The planned growth rate for this industry is expected to be substantially higher than the 9.5 per cent growth rate envisaged for the overall manufacturing sector.

xvii) During REPELITA III and REPELITA IV 18 key projects were planned in the basic metals industry sector with total investment requirements estimated at US $2,226 million. Some of these have been implemented while others are under negotiation or open for investment.

xviii) The realised and planned investment in the engineering and capital goods industry during REPELITA III and REPELITA IV would result in a significant increase in national capacity. In this context the Government has formulated programmes for the development of national capacity for certain key industrial products and estimates of supply and demand have been elaborated covering the period 1982/83-1986/87.

xix) Repelita IV contains specific programmes for development of: mechanical equipment industry; agricultural machinery and equipment; heavy equipment industry; electric equipment industry; electronic equipment; motor vehicle industry; railway industry; aviation industry; shipping industry; as well as iron and steel and metal industry.

STATISTICAL ANNEX

EXPLANATORY NOTE

Definition of ISIC 371 and ISIC 38

ISIC	
37100	Iron and Steel Basic Industry
38111	Agriculture, hand tools
38112	Cutlery, screws, bolts
38113	Kitchen apparatus
38120	Metal furniture and fixture
38130	Structural metal products
38140	Metal containers
38190	Metal products n.e.c.
38200	Machinery and repair
38311	Storage batteries
38312	Dry cell batteries
38320	Radio, TV, comm. equip.
38330	Elec. apparatus/supplies
38340	Repair of elec. appl.
38411	Ship building and repair
38430	Motor vehicles ass./manu.
38440	Motor cycle/3 wheel veh.
38450	Bicycle, becak ass./manu.
38460	Motor vehicle body + equip.
38490	Transport equip. n.e.c.
38500	Manu. of scientific equip.
38	Metal products, machinery and equipment

Annex Table 1

Gross output, value added, share of wages and salaries in value added, 1975, 1980 and 1981

(values in Rp. thousand million, current prices)

ISIC		Gross Output						Value Added						Share of Wages and Salaries in Value Added %		
		1975		1980		1981		1975		1980		1981				
		Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	1975	1980	1981
371	Iron and Steel Industries	5.0	-	237.7	-	249.4	-	1.1	-	70.0	-	79.5	-	32	13	12
381	Metal Products	65.8	37.2	285.3	24.6	338.7	22.6	16.9	26.5	74.2	20.7	85.4	16.1	32	29	33
382	Non-electrical Machinery	20.1	11.4	81.3	7.0	110.4	7.4	8.0	12.6	33.4	9.3	42.9	8.1	24	24	24
383	Electrical Machinery	53.5	30.2	387.1	33.5	442.9	29.6	18.3	28.7	112.6	31.5	125.9	23.6	20	22	23
384	Transport Equipment	37.1	21.0	402.8	34.7	604.8	40.3	20.3	31.9	136.2	38.1	277.8	52.1	36	20	14
385	Scientific, Photographic Equipment	0.5	0.2	2.8	0.2	2.1	0.1	0.2	0.3	1.4	0.4	0.7	0.1	40	26	56
	Total ISIC 38	177.0	100.0	1,159.3	100.0	1,498.9	100.0	63.7	100.0	357.8	100.0	533.0	100.0	29.2	22.8	20.0

Source: Survey of Manufacturing Industries, BPS, Indonesia, 1975, 1980 and 1981.

Annex Table 2

Value added per person engaged in million Rp. and index 1975, 1980 and 1981

		Value Added Per Person Engaged (million Rp.)			Value Added Per Person Engaged (Index=Total ISIC 38= 100)		
		1975	1980	1981	1975	1980	1981
371	Iron and Steel Industries	0.4	7.6	8.4	38.9	257.9	208.2
381	Metal Products	0.8	1.8	1.9	77.2	61.3	48.3
382	Non-electrical Machinery	0.9	2.8	3.4	93.1	94.1	84.1
383	Electrical Machinery	1.7	3.0	3.2	144.1	102.2	80.7
384	Transport Equipment	1.0	4.5	7.7	107.3	154.2	192.0
385	Scientific, Photographic Equipment	0.4	1.5	0.7	39.7	49.4	17.6
	Total ISIC 38	1.0	2.9	4.0	100.0	100.0	100.0

Source: Statistical Yearbooks of Indonesia (various issued).

Annex Table 3

Average annual rate of growth of value added, employment and labour productivity 1975-80 and 1980-81

ISIC		Value Added[a]		Employment		Labour Productivity	
		1975-80	1980-81	1975-80	1980-81	1975-80	1980-81
		------Percentage-------		-----Percentage---		----Percentage-----	
371	Iron and Steel Industries	93.9	12.2	25.1	7.5	68.8	4.7
381	Metal Products	13.5	13.7	12.8	7.3	0.7	6.4
382	Non-electrical Machinery	12.5	26.9	6.4	5.0	6.1	21.9
383	Electrical Machinery	21.5	10.5	29.0	3.7	7.5	6.8
384	Transport Equipment	23.6	101.5	9.2	19.9	14.4	81.6
385	Scientific, Photographic Equip.	24.7	-50.6	16.7	3.3	8.0	-47.3
Total ISIC 38		19.3	47.2	14.6	9.0	4.7	38.2

Source: Survey of Manufacturing Industries, BPS, Indonesia, 1975, 1980 and 1981.
Statistical Yearbooks of Indonesia.

[a] Real growth rates, using the general manufacturing price index.

Annex Table 4

Number and Size of Establishments in ISIC 371 Iron and Steel Basic Industries and ISIC 38 Metal Products, Machinery and Equipment 1975, 1980 and 1981.

	Number of Establishments			Average Plant Size (Persons Engaged Per Establishment)		
ISIC	1975	1980	1981	1975	1980	1981
37100	13	23	22	222	384	431
38111	14	22	22	57	81	68
38112	34	41	39	75	100	110
38113	45	53	51	112	112	126
38120	25	46	46	50	56	72
38130	65	93	95	116	142	149
38140	42	62	60	70	107	130
38190	57	46	42	41	149	156
38200	98	132	128	90	91	99
38311	10	12	13	54	86	88
38312	14	11	9	264	539	692
38320	18	34	36	268	427	448
38330	33	53	55	41	296	274
38340	2	3	2	25	65	83
38411	30	42	46	245	167	158
38430	25	32	38	349	357	375
38440	8	15	14	-	371	491
38450	26	35	33	48	46	54
38460	29	50	55	69	86	104
38490	-	4	2	-	17	17
38500	15	25	27	31	40	38
38	590	811	813	104	150	163

Source: Survey of Industries, BPS, Indonesia Vol. I, 1975, 1980 and 1981.

Employment in ISIC 371 Iron and Steel Basic Industries and ISIC 38, Metal Products, Machinery and Equipment 1975, 1980 and 1981.

ISIC	Persons Engaged						1975-80 Average Annual Rate of Growth	1980-81 Average Annual Rate of Growth
	1975		1980		1981			
	No.	%	No.	%	No.	%		
37100	2,883	-	8,822	-	9,483	-	25.1	7.5
38111	803	1.3	1,782	1.5	1,492	1.1	17.3	-16.3
38112	2,537	4.1	4,096	3.4	4,285	3.2	10.0	4.6
38113	5,040	8.2	5,915	4.9	6,434	4.9	3.2	8.8
38120	1,255	2.0	2,566	2.1	3,321	2.5	4.5	29.4
38130	7,510	12.2	13,240	10.9	14,129	10.7	12.0	6.7
38140	2,928	4.8	6,605	5.4	7,825	5.9	17.7	18.5
38190	2,361	3.8	6,851	5.6	6,551	4.9	23.7	-4.4
38200	8,833	14.4	12,055	9.9	12,658	9.6	6.4	5.0
38311	545	0.9	1,029	0.8	1,147	0.9	13.6	11.5
38312	3,689	6.0	5,932	4.9	6,229	4.7	10.0	5.0
38320	4,815	7.8	14,527	12.0	16,142	12.2	24.7	11.1
38330	1,364	2.2	15,706	12.9	15,095	11.3	63.0	-3.9
38340	50	0.1	194	0.2	165	0.1	31.2	-14.9
38411	7,357	12.0	7,034	5.8	7,261	5.5	-0.9	3.2
38430	8,727	14.2	11,424	9.4	14,250	10.8	5.5	24.7
38440	-		5,568	4.6	6,869	5.2	-	23.4
38450	1,260	2.0	1,614	1.3	1,795	1.4	5.1	11.2
38460	2,012	3.3	4,284	3.5	5,740	4.3	16.3	34.0
38490	-		67	0.1	34	-	-	-49.2
38500	460	0.8	990	0.8	1,023	0.8	16.6	3.3
38	61,546	100.0	121,479	100.0	132,445	100.0	14.6	9.0

Source: Survey of Industries, BPS, Indonesia Vol. I, 1975, 1980, 1981.

Annex Table 6

Value Added in ISIC 371 Iron and Steel Basic Industry and ISIC 38 Metal Products, Machinery and Equipment 1975, 1980 and 1981.

	1975		1980		1981	
ISIC	Mill. Rp.	%	Mill. Rp.	%	Mill. Rp.	%
371	1,097.0	-	66,996.9	-	79,487.9	-
38111	145.7	0.2	1,660.3	0.5	1,178.9	0.2
38112	1,127.8	1.8	6,453.6	1.8	9,660.8	1.8
38113	1,087.7	1.7	2,672.0	0.8	3,919.0	0.7
38120	639.3	0.7	1,882.7	0.5	3,528.6	0.7
38130	11,410.0	17.9	44,898.9	12.6	47,080.3	8.8
38140	1,878.2	3.0	11,902.7	3.3	15,557.9	2.9
38190	800.3	1.3	4,681.3	1.3	4,776.3	0.9
38200	8,034.4	12.6	33,418.0	9.3	42,858.2	8.1
38311	860.9	1.4	3,608.6	1.0	5,939.0	1.1
38312	2,721.5	4.3	10,682.3	3.0	12,134.8	2.3
38320	10,476.7	16.4	39,330.0	11.0	46,061.5	8.7
38330	4,200.1	6.6	58,776.0	16.4	61,398.2	11.5
38340	17.3	0.1	171.2	0.1	409.2	0.1
38411	6,199.3	9.7	20,197.6	5.6	26,864.8	5.0
38430	12,204.3	19.2	77,386.8	21.6	101,277.6	19.0
38440	55.2	0.1	30,595.4	8.6	137,426.7	25.8
38450	977.5	1.5	1,068.5	0.3	1,274.3	0.2
38460	893.2	1.4	6,853.3	1.9	10,993.6	2.1
38490	-	-	46.0	0.1	35.7	-
38500	177.6	0.3	1,440.9	0.4	724.3	0.1
38	63,701.9	100.0	357,726.1	100.0	533,099.7	100.0

Source: Survey of Industries, BPS, Indonesia, Vol. I, 1975, 1980, 1981.

Gross Output for ISIC 371 Iron and Steel Basic Industry and ISIC 38 Metal Products, Machinery and Equipment 1975, 1980 and 1981

	Gross Output Mill. Rp.		
ISIC	1975	1980	1981
371	5,027.3	237,707.1	249.405.9
38111	257.7	2,825.2	2,578.1
38112	7,692.3	42,355.5	47,272.5
38113	4,041.0	9,679.9	12,878.9
38120	1,245.5	5,446.7	9,416.4
38130	44,493.3	180,979.9	209,553.6
38140	5,839.1	30,631.2	42,889.0
38190	2,223.0	13,401.2	14,117.6
38200	20,137.7	81,291.0	110,433.5
38311	1,905.0	9,707.0	13,451.4
38312	11,900.0	39,204.9	43,215.4
38320	27,862.8	191,951.3	230,177.7
38330	11,805.4	145,727.7	155,466.2
38340	20.5	553.5	621.5
38411	12,691.6	34,767.5	43,547.4
38430	20,476.0	196,627.5	242,479.5
38440	304.0	147,037,0	284,674.7
38450	1,843.4	3,574.4	4,016.3
38460	2,076.2	20,692.0	29,923.0
38490	-	75.1	110.8
38500	461.9	2,816.1	2,016.9
38	177,276.4	1,159,344.6	1,498,885.4

Source: Survey of Industries, BPS, Indonesia Vol.I, 1975, 1980 and 1981.

Annex Table 8

Ratio of Value Added to Gross Output, 1975, 1980 and 1981

ISIC	1975	1980	1981
371	21.8	28.2	31.8
38111	56.6	58.8	45.7
38112	14.7	15.2	20.4
38113	26.9	27.6	30.4
38120	35.2	34.6	37.5
38130	25.6	24.8	22.5
38140	32.2	38.8	36.3
38190	36.0	34.9	33.8
38200	40.0	41.1	38.8
38311	45.2	37.2	44.2
38312	22.9	27.2	28.1
38320	37.6	20.5	20.0
38330	35.6	40.3	39.5
38340	84.3	30.9	65.8
38411	48.8	58.1	61.7
38430	59.6	39.4	41.8
38440	-	20.6	48.3
38450	53.0	29.9	31.7
38460	43.0	33.2	36.7
38490	-	61.2	32.2
38500	38.4	51.2	35.1
38	35.9	30.9	35.6

Source: Survey of Industries, BPS, Indonesia, 1975, 1980 and 1981.

Annex Table 9

Wages and Salaries and Labour Intensity ISIC 371 Iron and Steel Industry and ISIC 38 Metal Products, Machinery and Equipment 1975, 1980 and 1981

(values in million Rp.)

ISIC	Total Employment Costs (Wages and Salaries) (million Rp.)			Share of Wages and Salaries in Value Added		
	1975	1980	1981	1975	1980	1981
371	356	8,932.0	9,190.5	32.4	13.3	11.6
38111	63.7	515.6	649.1	43.8	31.0	55.1
38112	431.0	1,925.7	2,424.6	38.2	29.8	25.1
38113	581.5	1,572.7	2,367.6	53.5	58.9	60.4
38120	178.9	765.1	1,376.8	40.8	40.6	39.0
38130	2,774.9	10,059.8	12,151.1	24.3	22.4	25.8
38140	1,154.4	4,541.0	7,120.4	61.4	38.2	45.8
38190	257.2	1,917.6	1,993.0	32.1	41.0	41.7
38200	1,899.4	8,101.4	10,172.6	23.6	24.2	23.7
38311	176.8	651.1	947.5	20.5	18.0	16.0
38312	828.6	4,527.5	5,934.3	30.4	42.4	48.9
38320	1,456.5	9,062.1	10,765.4	13.9	23.0	23.4
38330	400.4	9,998.0	11,563.2	9.5	17.0	18.8
38340	10.1	79.3	92.0	58.4	46.3	22.5
38411	3,169.9	5,917.8	7,206.2	51.1	29.3	26.8
38430	3,344.0	13,446.7	17,723.5	27.4	17.4	17.5
38440	-	5,097.8	8,479.5	-	16.7	6.2
38450	264.1	636.4	601.2	27.0	59.6	47.2
38460	511.7	2,352.6	4,403.3	57.3	34.3	40.1
38490	-	23.8	21.3	-	51.9	59.6
38500	69.8	368.1	405.4	39.3	25.5	56.0
38	17,572.9	81,560.1	106,398.0	27.6	22.8	20.0

Source: Survey of Industries, BPS, Indonesia, 1975, 1980 and 1981.

Annex Table 10

Labour Productivity in ISIC 371 Iron and Steel Basic Industry and ISIC 38 Metal Products, Machinery and Equipment, 1975, 1980 and 1981

	Value Added per Person Engaged (000 Rp.)			Value Added per Person Engaged (Index total ISIC 38=100)		
	1975	1980	1981	1975	1980	1981
371	380	7,594	8,382	-	-	-
38111	181	932	790	18	32	20
38112	444	1,598	2,254	43	54	56
38113	216	452	609	21	15	15
38120	350	734	1,063	34	25	26
38130	1,519	3,391	3,332	147	115	83
38140	641	1,802	1,988	62	61	49
38190	339	683	729	33	23	18
38200	910	2,772	3,386	88	94	84
38311	1,580	3,507	5,178	153	119	129
38312	738	1,801	1,948	71	61	48
38320	2,176	2,707	2,854	210	92	71
38330	3,079	3,742	4,067	298	127	101
38340	345	882	2,480	33	30	62
38411	843	2,871	3,700	81	98	92
38430	1,398	6,774	7,107	135	230	177
38440	-	5,495	20,006	-	187	497
38450	776	662	710	75	23	18
38460	444	1,600	1,915	43	54	48
38490	-	686	1,050	-	23	26
38500	386	1,455	708	37	49	18
38	1,035	2,945	4,025	100	100	100

Source: Survey of Industries, BPS, Indonesia, Vol. , 1975, 1980 and 1981.

Annex Table 11

Employment Cost: Total and Per Person Engaged, 1981

ISIC	Total Employment Cost Annually (million Rp.)	Employment Cost Per Person Engaged (000 Rp.)	
		Annually (000)	Per Month
371			
38111	649	435	36.2
38112	2,425	566	47.2
38113	2,368	368	30.7
38120	1,377	415	34.6
38130	12,151	860	71.7
38140	7,120	910	75.8
38190	1,993	304	25.3
38200	10,173	804	67.0
38311	947	826	68.8
38312	5,934	953	79.4
38320	10,765	667	55.6
38330	11,563	766	63.8
38340	92	558	46.5
38411	7,206	992	82.7
38430	17,724	1,244	103.6
38440	8,479	1,234	102.9
38450	601	335	27.9
38460	4,403	767	63.9
38490	21	625	52.1
38500	405	396	33.0
38	106,397	803	66.9

Source: Survey of Manufacturing Industries, BPS, Indonesia, 1981.

Annex Table 12

Geographical distribution of ISIC 371, iron and steel basic industries, 1981

Area	Number of Establishments	Persons Engaged		Avg. Plant Size	Gross Output	Value Added
	No.	No.	%	Persons Engaged per Enterprise		
1. Jakarta	10	2,688	28.3	269		
2. Java	8	6,241	65.8	780		
-Yogyakarta	0	0	0	-		
-East Java	4	1,699	17.9	425		
-West Java	1	4,141	43.7	4,141		
-Central Java	3	401	4.2	134		
3. Sumatra	3	479	5.1	160		
4. Sulawesi	1	75	0.8	75		
5. Kalimantan	0	0	0	-		
6. Others	0	0	0	-		
Total (Indonesia)	22	9,483	100	431	n.a.	n.a.

Source: BPS, unpublished figures.

Annex Table 13

Geographical distribution of ISIC 381, metal products, 1981

Area	Number of Establishments No.	Persons Engaged No.	Persons Engaged %	Avg. Plant Size Persons Engaged per Enterprise	Gross Output	Value Added
1. Jakarta	125	17,798	41.2	142		
2. Java	179	23,227	53.7	130		
-Yogyakarta	8	357	0.8	45		
-East Java	93	12,699	29.4	137		
-West Java	45	7,212	16.7	160		
-Central Java	33	2,959	6.8	90		
3. Sumatra	34	1,594	3.7	47		
4. Sulawesi	8	213	0.5	27		
5. Kalimantan	1	85	0.2	85		
6. Others	8	324	0.8	41		
Total (Indonesia)	355	43,241 (44,037)	100	5,405	n.a.	n.a.

Source: BPS, unpublished figures.

Annex Table 14

Geographical distribution of ISIC 382, non-electrical machinery, 1981

Area	Number of Establishments	Persons Engaged		Avg. Plant Size	Gross Output	Value Added
	No.	No.	%	Persons Engaged per Enterprise		
1. Jakarta	20	2,493	19.7	125		
2. Java	95	9,381	74.1	99		
-Yogyakarta	1	655	5.2	655		
-East Java	30	4,744	37.5	158		
-West Java	34	2,420	19.1	71		
-Central Java	30	1,562	12.3	52		
3. Sumatra	13	784	6.2	60		
4. Sulawesi	0	0	-	-		
5. Kalimantan	0	0	-	-		
6. Others	0	0	-	-		
Total (Indonesia)	128	12,658	100	99	n.a.	n.a.

Source: BPS, unpublished figures.

Annex Table 15

Geographical distribution of ISIC 383, electrical machinery, 1981

Area	Number of Establishments No.	Persons Engaged No.	Persons Engaged %	Avg. Plant Size Persons Engaged per Enterprise	Gross Output	Value Added
1. Jakarta	55	23,712	61.1	431		
2. Java	54	13,564	35.0	251		
-Yogyakarta	1	239	0.6	239		
-East Java	10	2,845	7.3	285		
-West Java	34	9,433	24.3	277		
-Central Java	9	1,047	2.7	116		
3. Sumatra	6	1,502	3.9	250		
4. Sulawesi	0	0	-	-		
5. Kalimantan	0	0	-	-		
6. Others	0	0	-	-		
Total (Indonesia)	115	38,778	100	337	n.a.	n.a.

Source: BPS, unpublished figures.

Annex Table 16

Geographical distribution of ISIC 384, transport equipment, 1981

Area	Number of Establishments No.	Persons Engaged No.	Persons Engaged %	Avg. Plant Size Persons Engaged per Enterprise	Gross Output	Value Added
1. Jakarta	58	22,318	62.1	385		
2. Java	93	11,174	31.1	120		
-Yogyakarta	1	151	4.2	151		
-East Java	41	4,885	13.6	119		
-West Java	28	3,484	9.7	124		
-Central Java	23	2,654	7.4	115		
3. Sumatra	18	1,122	3.1	62		
4. Sulawesi	5	504	1.4	101		
5. Kalimantan	7	189	5.3	27		
6. Others	11	642	1.8	58		
Total (Indonesia)	192 (188)	35,949	100	188	n.a.	n.a.

Source: BPS, unpublished figures.

Annex Table 17

Geographical distribution of ISIC 385, scientific, photographic equipment, 1981

Area	Number of Establishments	Persons Engaged		Avg. Plant Size	Gross Output	Value Added
	No.	No.	%	Persons Engaged per Enterprise		
1. Jakarta	2	92	9.0	46		
2. Java	24	918	89.7	38		
-Yogyakarta	10	263	25.7	26		
-East Java	6	326	31.9	54		
-West Java	4	230	22.5	58		
-Central Java	4	99	9.7	25		
3. Sumatra	1	13	1.3	13		
4. Sulawesi	0	0	–	–		
5. Kalimantan	0	0	–	–		
6. Others	0	0	–	–		
Total (Indonesia)	27	1,023	100	38	n.a.	n.a.

Source: BPS, unpublished figures.

Annex Table 18

Domestic Production of Electric Machinery and Equipment (ISIC 383), in Indonesia, 1980

	Unit	Physical production	Value (000 Rp.)	Price/Unit (Rp.)
1. Black and white TV	000 units	472	53,240,486	112,798
2. Integrated circuits	000 units	487,743	51,237,109	105
3. Colour TV	000 units	135	49,901,005	369,637
4. Dry cells	000 units	549,347	37,329,520	68
5. Electric cable	tons	16,423	22,931,804	1,396,323
6. Copper rods	tons	12,932	20,614,549	1,594,073
7. Radio tape recorders	000 units	540	19,994,025	37,026
8. Radios	000 units	990	16,814,324	16,984
9. Refrigerators	000 units	82	13,248,482	161,567
10. All other cables	000 meters	121,853	11,213,519	92
11. Accummulators	000 units	653	8,307,066	12,721
12. Air conditioners	000 units	37	7,985,937	215,836
13. Tape recorders	000 units	296	6,479,291	21,889
14. Cassette recorders	000 units	23,878	5,711,360	239
15. Fans	000 units	214	4,896,054	22,878
16. Lamp bulbs 1	000 units	29,171	4,197,489	144
17. Transformers	units	1,745	3,492,548	2,001,460
18. Plugs	000 units	11,457	3,218,561	281
19. BC	tons	1,656	2,919,108	1,762,746
20. TL lamps	000 units	4,964	2,756,536	555
21. Melamine sheets	000 sheets	603	2,413,644	4,002
22. Enamel wire	tons	817	2,254,546	2,759,542
23. Sewing machines	000 units	110	2,028,843	18,444
24. Other dry cells	-	-	1,596,101	-
25. Speakers	000 pieces	1,367	1,241,015	908
26. Electric panels	units	1,029	1,178,379	1,145,169
27. Transceivers	sets	242	1,143,596	4,725,603
28. Trafo TL	000 units	1,929	1,027,385	532
29. Gas appliances	000 sets	22	886,680	40,304
30. Amplifier	000 units	20	819,782	40,989
31. Tape decks	000 units	10	811,325	81,133
32. Switches	000 units	216	699,633	3,239
33. Speakers	000 units	48	672,000	14,000
34. Bulb lamps 2	000 units	34,772	629,487	18
35. PVC	tons	210	623,847	2,970,700
36. Cassettes, recorded	000 units	1,068	609,286	570
37. Exhaust fans	000 sets	31	608,156	19,618
38. Glass tubes TL	000 units	8,732	546,601	63
39. Separator accummulators	000 sheets	21,755	543,877	25
40. PVC - FM	000 units	2	525,000	262,500
41. Tuners	000 units	123	482,311	3,921
42. Accummulator plates	000 units	2,294	464,838	203
43. Rice cookers	000 sets	32	463,376	14,481
44. Transceivers	units	130	455,000	3,500,000
45. Switch board panels	units	700	420,000	600,000
46. Lamp base	000 units	22,824	413,114	18
47. Electric tools	000 coils	57	365,396	6,410
48. Transformers	000 units	118	333,484	2,826
49. Lamp talan	000 units	4	320,878	80,220
50. PVC AM	000 units	4	315,000	78,750
51. Decorative lamps	000 units	2,533	267,450	106
52. Radio sender/transmitter	000 units	560	246,957	441
53. Others	-	-	15,249,262	-
Total (gross output, ISIC 383)	-	-	387,144,415	-

Source: BPS: Survey of Industries, 1980.

Annex Table 19

Nominal and effective protection in Indonesian manufacturing, 1975

IO code	Sector name	Nominal rate of protection (%)	Effective rate of protection (%)
Exportable Sectors			
5	Dried cassava and tapioca flour	-10.00	-10.75
13	Smoking and remilling of rubber	-11.00	-10.90
18	Farm coconut oil	-10.00	-10.07
19	Palm Oil	-15.00	-4.61
22	Processed tobacco	-11.00	-11.89
26	Farm processed tea	-1.00	-11.89
34	Slaughtering	-4.00	-5.26
43	Fish slating and drying	0.00	-1.19
62	Coconut and cooking oil	-10.00	-11.04
69	Cocoa, chocolate and sugar confectionary	8.00	15.02
73	Other food products, not elsewhere classified	0.00	4.90
80	Batik industries	0.00	-35.19
85	Tanneries and leather finishing	0.00	1.89
88	Sawmills, planing and other wood processing	0.00	13.38
89	Wood and cord products	0.00	-1.20
Noncompeting Import Sectors			
118	Iron and steel basic industries	13.43	18.14
124	Non-electrical machinery	15.70	18.00
125	Electrical industrial machinery and apparatus	12.46	10.30
129	Other electrical apparatus, supplies and repair	15.55	-4.11
135	Aircraft industry	-4.33	-24.07
136	Professional and scientific instruments and repair	8.92	3.54
137	Photographic and optical goods	19.97	14.37
94	Basic industrial chemicals, excluding fertilizer	15.31	26.03
101	Pesticides and agricultural chemicals	17.26	30.65
102	Other chemical industries	47.55	411.05
Import-Competing Sectors			
58	Canning and preserving meat	61.91	neg. IVA
59	Diary products	40.00	221.36
60	Fruits and vegetables	68.21	208.87
61	Canning and preserving fish and other sea food	58.94	neg. IVA
63	Other vegetables and animal oils and fats	13.30	403.22
64	Rice milling, cleaning and polishing	-23.72	0.93
65	Wheat flour and other grain mill products	-15.00	neg. IVA
66	Sugar refinery	-7.44	-9.32
67	Bread and bakery products	16.12	82.69
68	Macaroni noddle and similar products	14.00	623.03
74	Alcoholic beverages	83.84	116.48
75	Soft drinks and carbonated water	56.61	106.08
76	Cigarettes	18.00	4.22
77	Spinning industries	14.00	56.00

(Annex Table 19 Continued)

IO code	Sector name	Nominal rate of protection (%)	Effective rate of protection (%)
78	Weaving industries	41.00	191.69
79	Textile bleaching, printing, dyeing excl. batik	22.00	42.01
81	Knitting industries	53.00	331.49
82	Made-up textile goods, excluding wearing apparel	58.69	297.63
83	Wearing apparel, excluding footwear	51.00	110.04
84	Carpets, rugs, ropes and others	27.54	101.42
86	Leather products, excluding footwear	57.62	152.65
87	Leather footwear	69.40	174.53
90	Furniture and fixtures, excluding those primary metal	15.00	51.90
91	Pulp, paper and cardboard	23.50	45.78
92	Paper products	51.04	87.29
93	Printing, publishing and allied industries	28.12	32.55
96	Paints, varnishes, lacquers	18.13	21.77
97	Drugs and medicines	73.88	150.49
98	Soap and cleaning preparations	48.67	neg. IVA
99	Cosmetics	77.55	315.21
100	Matches	34.23	77.17
109	Other petroleum and coal products	55.69	neg. IVA
110	Tyres and tubes	107.87	4,314.91
111	Other rubber products	46.82	406.40
112	Plastics	51.57	533.82
113	Ceramics	90.90	143.61
114	Glass and glass products	412.15	neg. IVA
115	Structural clay products	15.63	26.08
116	Cement	40.00	63.57
117	Other non-metallic mineral products	45.77	83.20
120	Cutlery, hand tools and general hardware	21.74	36.30
121	Furniture and fixtures, mainly metal	36.81	113.90
122	Structural metal products	15.15	17.47
123	Other fabricated metal products	32.10	66.10
126	Radio, television, communications equipment	67.00	210.01
127	Electrical appliances and housewares	70.00	340.82
128	Accumulators and dry batteries	39.07	116.37
130	Ship and boat building and repair	15.31	44.89
131	Railroad equipment	3.57	1.71
132	Motor vehicles	80.00	717.73
133	Motorcycles, bicycles and other vehicles	65.00	88.05
138	Jewellery and related articles	40.73	238.21
139	Musical instruments	49.84	122.90
140	Sports and athletic goods	24.84	31.46
141	Other manufacturing industries	62.14	430.23

Source: World Bank, 1979.

Industrial Projects Cited in 16 August 1982 State Address

No.	Category/project/factory	Location	Status	Products	Capacity	Target completion date	Est. cost ($m)	Remarks
I.	**BASIC CHEMICALS:** 27 projects, total investment $9,198 m.							
1.	Fertilizer distribution	Multiple	New	Fertilizer marketing	-	n.a.	357	Capital cost involves purchase of bulk carriers and railway rolling stock, construction of packaging plants and warehouses. Project underway.
2.	Kaltim Fertilizer I	E. Kal	New	Urea Amonia	570,000 tons/yr 165,000 tons/yr	1982	367	Trial operation has commenced.
3.	ASEAN Fertilizer	Aceh	New	Urea	570,000 tons/yr	1983	313	Under construction.
4.	Iskandar Muda Fertilizer	Aceh	New	Urea Amonia	1,725 tons/day 1,000 tons/day	1984	385	Site being prepared.
5.	PT Petrokimia	Gresik	Exp.	TSP	500,000 tons/yr	1983	117	(Includes harbour and water (purification plant.
6.	PT Petrokimia	Gresik	Exp.	Phosphoric and sulf. acid, gypsum	1.5m. tons/yr	n.a.	256	(Both plants under (construction.
7.	Kaltim Fertilizer II	E. Kal.	New	Urea Amonia	570,000 tons/yr 165,000 tons/yr	1984	375	Represents first phase expansion of Kaltim I. Now under construction.
8.	PN Leces Pulp and Paper	E.Java	Exp.	Writing/ priting paper	260 tons/day	1984	220	(Represents 3rd and 4th phase (expansion of Leces. Raw material: (bagasse. Phase III already (under construction. (
9.	PN Leces Pulp and Paper	E.Java	Exp.	Newsprint	90,000 tons/yr	1985	220	(

(Annex Table 20 continued)

No.	Category/project/factory	Location	Status	Products	Capacity	Target completion date	Est. cost ($m)	Remarks
10.	Cilacap Pulp and Paper	W.Java	New	Kraft paper/ cement bags	90,000 tons/yr	1985	200	
11.	Integrated forest-based industry	E.Kal.	New	Plywood/timber prods. Pulp	203,500 m^3/yr 165,000 tons/yr	1985	650	
12.	Olefin Centre[a]	Aceh	New	Ethane Ethylene Caustic soda Other	450,000 tons/yr 340,000 tons/yr 251,000 tons/yr 540,000 tons/yr	1988	2,800	Exxon has tentatively agreed to major equity investment in ethane extraction-phase (est. $300 m.) Japanese and local partners envisaged for VCM, caustic soda, and EDC phase. Preliminary studies still in course.
13.	Aromatics Centre	S.Sum.	New	Benzone PTA Cyclohexana Other	256,000 tons/yr 225,000 tons/yr 180,000 tons/yr 66,000 tons/yr	1986	1,785	Main constrators: Thyssen/Pullman Kellog; design work underway.
14.	PT Semen Padang	W.Sum	Exp.	Cement	600,000 tons/yr	1983	138	Unit IIIA under construction.
15.	PT Semen Padang	W.Sum	Exp.	Cement	600,000 tons/yr	1984	132	Unit IIIB under construction.
16.	PT Semen Tonasa	S.Sul	Exp.	Cement	590,000 tons/yr	1984	144	Under construction.
17.	PT Semen Cibinong	W.Java	Exp.	Cement	800,000 tons/yr	1984	120	Site being prepared.
18.	Kupang Cement	NTT	New	Cement	120,000 tons/yr	1984	35	Described as 'mini' plant; under construction.
19.	Madura Cement	Madura	New	Cement	2m. tons/yr	n.a.	438	
20.	PT Semen Baturaja	S.Sum	Exp.	Cement	500,000 tons/yr	n.a.	130	

No.	Category/project/factory	Location	Status	Products	Capacity	Target completion date	Est. cost ($m)	Remarks
21.	Industrial Rubber	Cilegon	New	Industrial rubber products, heavy duty tyres	n.a.	n.a.	160	License issued.
22.	Soda ash project	Gresik	New	Soda ash	200,000 tons/yr	n.a.	120	
23.	Industrial salt proj.	NTT	New	Industrial salt	n.a.	n.a.	90	
24.	Polyester Factory[a]	Gresik	New	Polyester	n.a.	n.a.	(175	Under construction.
25.	Polyester Factory[a]	Cilegon	New	Polyester	n.a.	n.a.	(	
26.	Ammonium nitrate factory	W.Java	New	Amm. nitrate for explosives	n.a.	n.a.	56	
27.	Dissolving pulp proj.	S.Sum	New	Rayon fibre	n.a.	n.a.	400	
II.	BASIC METALS: 18 projects, total investment $2,226m.							
28.	Pellet factory[b]	Cilegon	n.a.	Iron pellets	3m. tons/yr	1984	130	Under construction[b].
29.	Slab factory and Hot Strip Mill [b]	Cilegon	n.a.	Slab and hot strip	n.a.		n.a.	Project completed[b].
30.	Cold Sheet Mill	Cilegon	n.a.	Cold rolled sheet	500,000 tons/yr	1983	490	
31.	Tin plate factory	Cilegon	n.a.	Tin plate	60-100,000 tons/yr	1985	57	
32.	Seamless pipe factory	n.a.	new	Seamless pipe	150,000 tons/yr	1985	186	
33.	Diesel/gasoline engine factory	Java	New	Diesel/gasoline engines	200,000 units	1984	448	License issued.
34.	Shipyards	Jkt/S'baya UP/Palbg	New	(New ships (Repairs	21,000 BRT 540,000 BRT	1984	50	Construction underway.

No.	Category/project/factory	Location	Status	Products	Capacity	Target completion date	Est. cost ($m)	Remarks
35.	Casting prods. factory	Cilegon	n.a.	Casting products	48,000 tons/yr	1984	91	
36.	Forging prods. factory	Cilegon	n.a.	Parts, chassis, transmissions	31,000 tons/yr	1984	75	
37.	Machine tool factory	Cilegon	n.a.	Lathes	650 units	1984	4	License issued.
38.	Heavy equipment fact.[a]	Java	New	Wheel loaders Crawler tractors Excavators	2,980 units 700 units 100 units	n.a.	147	
39.	Railway carriage fact.	Madiun	New	Freight cars Passenger cars	200 units 42 units	1984	96	Under construction.
40.	Power train factory	Jkt. or Sby.	New	Suspension/ steering systems for motor vehicles	150,000 units	1985	38	
41.	Motorcycle engine factory	Jkt. or Sby.	New	Motorcycle engines	200,000 units	1985	17	
42.	General Machinery	Jkt. or Sby.	New	Sugar, palmoil mill and crumb rubber	465,000 tons/yr	1985	235	
43.	Copper cathode fact.	O.I.	New	Copper cathodes	40,000 tons/yr	1985	130	
44.	Heavy elect. machinery	Jkt. or Sby	New	Heavy elect. eqpt.	n.a.	1985	28	
45.	Die and Mould factory	n.a.	New	Dies and moulds	n.a.	1985	5	

No.	Category/project/factory	Location	Status	Production	Capacity	Target completion date	Est. cost ($m)	Remarks
III.	LIGHT MANUFACTUIRNG: 7 projects, total investment $369m.							
46.	PT Sandang I	W.Java	Exp.	Weaving yarn and improvement in quality	n.a.	1983	74	Expansion to 90,000 spindles.
47.	PT Sandang II	E. Java	Exp.		n.a.	1983	99	Expansion to 120,000 spindles.
48.	PT Primissima	Yogya	Exp.		n.a.	1982	50	Expansion to 60,000 spindles.
49.	Pinda Sandang	C.Java	Exp.		n.a.	1983	25	Expansion to 30,000 spindles.
50.	PN Garam	Madura	Exp.	Salt	300,000 tons/yr	1986	25	Rehabilitation (production includes present output). Contract signed.
51.	Science-based Indust. Park	Jkt./Bdg.	New	Electronics	n.a.	1985	19	
52.	Electronic Component Plt.	Bdg.	New	Electronics components	n.a.	1985	75	
IV.	PERTAMINA REFINERY AND PETROCHEMICAL PLANNED PROJECTS NOT INCLUDED ABOVE: 6 projects $6,387m.							
1.	Cilacap Refinery	Cilacap	Exp.	Refinery products	215 MBSD	1983	1,178	Pertamina share $223m, main contractor Fluor Eastern Inc. Construction 31% completed.
2.	Balikpapan Refinery	E.Kal	Exp.	Refinery products	228 MBSD	1983	1,509	Pertamina share $385m, main contractor Bechtel Internatl. Construction 13% completed.
3.	Dunai Hydrocracker	Riau	New	Refinery products	82 MBSD	1983	1,521	Pertamina share $370m, main contractor Tecnicas-Reunidas/ Centurion. Construction 7% completed.

(Annex Table 20 continued)

No. C	gory/project/factory	Location	Status	Products	Capacity	Target completion date	Est. cost ($m)	Remarks
4. M	anol Project	E.Kal	New	Methanol	330,000 tons/yr	1985	341	Land clearing almost completed.
5. A	LNG Refinery	Aceh	Exp.	LNG	3.3m. tons/yr	1984	842	Main contractor Choyoda Chem. Eng. Construction 2% completed.
6. B	k LNG Refinery	E.Kal	Exp.	LNG	3.3m. tons/yr	1983	996	Main contractor Bechtel Internatl. Construction 28% completed.

Sourc Ministry of Industry, 'Long Range Development Plan of Indonesia', Jakarta, 14 October 1982; and Pertamina.

Notes a/ Planned as joint venture.
b/ Not clear whether these and other projects in Cilegon are to be regarded as extensions of PT Krakatau Steel.

Supply and Demand Estimates ISIC (37) and ISIC (38), 1982-1987

ISI	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1985 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
3839	Storage battery and its components industry:							
	- Storage battery	85.04.191	Thousand pieces	4,059 3,521 4,700	7,646 6,116 5,097	8,288 6,630 5,525	8,986 7,189 5,990	9,748 7,799 6,499
3839	Battery industry:							
	- Dry battery	84.03.110	Thousand pieces	682,420 576,600 632,345	1,028,871 823,097 685,914	1,115,452 892,362 743,635	1,209,450 967,560 806,300	1,312,263 1,049,810 874,842
	Two-wheel motor vehicle industry:							
3841	- Motor Bicycle	87.09	Thousand pieces	750 577.4 488.5	1,050.0 609.3 529.8	1,170 660.5 574.3	1,170 716.1 622.7	1,470 776.9 675.6
371	Basic iron and steel industry:							
	- Pellet		Thousand tons	- - 704	- - 1,440	- - 1,980	- - 2,340	- - 2,700
	- Sponge iron	73.05.200	Thousand tons	2,000 391 350.5	2,000 800 700	2,000 1,100 900	2,000 1,300 1,100	2,000 1,500 1,300
	- Slab	73.07.930	Thousand tons	1,100 - 950	1,100 200 1,100	1,100 400 1,300	1,100 600 1,545	1,100 900 1,700
	- Ingot billet	73.06.200/ 73.07.100	Thousand tons	1,175 693.5 950	1,175 762 1,271	1,175 800 1,398	1,175 1,000 1,538	1,175 1,100 1,690

(Annex Table 21 continued)

IS	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
371	Metal foundry engineering Industry:							
	- Iron smelting	73.01.200	Thousand tons	71	71	71	71	71
				70	71	71	71	71
				93.5	110	140	170	200
	- Steel smelting	73.01.200	Thousand tons	6.5	6.5	6.5	6.5	6.5
				2.5	2.8	3.23	3.72	4.3
				2.7	3.4	4.25	5.3	6.62
371	Steel rolling and milling industry:							
	- Hot coil	73.11.200	Thousand tons	1,100	1,100	1,100	1,100	1,100
				10	241	432	650	970
				865	1,000	1,150	1,530	1,500
	- Cold rolled sheet	73.15.900	Thousand tons	-	-	-	-	850
				-	-	-	-	255
				-	600	700	845	950
	- Tin plate	73.13.100	Thousand tons	-	-	-	130	130
				-	-	-	-	78
				146.20	174	192	210	225
	- Reinforced steel/ light profile	73.10.932	Thousand tons	1,200	1,200	1,200	1,200	1,200
				745	1,026	1,200	1,200	1,200
				743.8	976	1,100	1,243	1,405
	- Steel wire	73.10.100/ 73.15.300	Thousand tons	416	416	416	416	416
				257.4	300	340	384	416
				257.4	300	340	384	434
	- Zinc plate	73.10.900	Thousand tons	490.8	490.8	490.8	490.8	490.8
				329.5	419	474	490.8	490.8
				329.5	419	474	535	604

(Annex Table 21 continued)

Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
Pipe industry:							
- Straight welded pipe	73.17.100	Thousand tons	375	375	375	375	375
			237	345	375	375	375
			300	345	396	448	506
- Spiral welded pipe	73.17.900	Thousand tons	60	60	60	60	60
			46.10	50	60	60	60
			46.19	50	85	115	140
- Seamless pipe	73.18.100	Thousand tons	-	-	-	-	160
			-	-	-	-	48
			113.75	130	150	175	200
Non iron metal making industry:							
- Aluminium ingot	76.01.200	Thousand tons	225	225	225	225	225
			12	115	175	225	225
			20.4	24	27.6	31.7	36.5
- Copper rod	74.03.200	Thousand tons	36	36	36	36	36
			18.5	26	30	34.5	36
			20	26	30	34.5	40
- Copper cathode	74.01.400	Thousand tons	-	-	-	-	-
			-	-	-	-	-
			44.6	49.5	51.5	59	65
- White tin ingot		Thousand tons	33	33	33	33	33
			33	33	33	33	33
			0.43	0.5	0.575	0.66	0.76
Non iron metal rolling industry:							
- Aluminium sheet	76.03.100	Thousand tons	21	21	21	21	21
			10.5	21	21	21	21
			18.5	22	25	29	33

(Annex Table 21 continued)

C	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
04	Non iron metal extrusion industry:							
	- Aluminium extrusion	76.02.900	Thousand tons	17	17	17	17	17
				12.3	16.5	17	17	17
				15.7	16.8	21	23	26
12	Combustion engineering industry:							
	- Diesel stationer	84.06	Unit	88,664	88,664	88,664	88,664	88,664
				70,455	70,455	67,160	69,220	80,640
				170,000	192,000	210,000	222,000	233,000
220	Agricultural machinery and accessories industry:							
	- Mini tractor	87.01.921	Unit	200	5,000	6,000	7,000	8,250
				116	3,000	4,500	6,000	8,250
				2,000	5,000	10,000	13,000	13,000
	- Hand tractor	87.01.942	Unit	2,150	5,000	10,000	15,000	18,790
				1,271	3,000	8,000	13,000	18,750
				5,500	5,000	10,000	14,000	19,000
	- Big tractor	87.0.122	Unit	-	-	-	-	2,000
				-	-	-	-	-
				1,350	1,500	1,650	1,800	1,900
	- Tresher	87.02.530	Unit	2,500	2,500	2,500	2,500	2,500
				1,274	1,279	1,400	1,550	1,700
				825	1,025	1,025	1,416	1,670
	- Huller	84.29.119	Unit	6,100	6,100	6,100	6,100	6,100
				1,654	1,687	1,800	1,900	2,050
				33,000	34,000	39,000	46,000	54,000
	- Polisher	84.25.400	Unit	3,520	3,520	3,520	3,520	3,520
				338	338	370	410	450
				33,000	34,000	39,000	46,000	54,000

(Annex Table 21 continued)

SIC	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
	- Rice milling unit	84.29.190	Unit	1,570 372 1,000	1,570 800 1,300	1,570 1,000 1,500	1,570 1,200 1,700	1,570 1,500 1,900
	- Rice Milling plant		Unit	8,000 372 5,000	8,000 372 6,000	8,000 400 7,200	8,000 430 8,700	8,000 460 10,400
	- Irigation water pump	84.10.300	Unit	7,200 2,110 4,600	7,200 2,110 5,500	7,200 2,230 6,600	7,200 2,450 8,000	7,200 2,700 9,500
38231	Metal processing/working machinery industry:							
	- Lathe machine	84.45.200	Unit	300 27 2,500	300 327 3,010	300 327 3,360	300 327 3,780	300 327 4,200
	- Bench drinlling machine	84.45.400	Unit	1,000 71 4,900	1,000 100 5,500	1,000 120 5,750	1,000 140 5,875	1,000 160 6,000
	- Sawing machine	84.45.500	Unit	4,000 120 6,900	4,000 120 8,400	4,000 120 8,800	4,000 120 8,960	4,000 120 9,120
	- Milling machine	84.45.610	Unit	250 25 500	250 25 560	250 25 600	250 25 650	250 25 700
	- Bending machine		Unit	100 25 600	100 25 650	100 50 700	100 100 750	100 100 800
38292	Heavy equipment industry:							
	- Road/vibro roller	84.09	Unit	1,140 404 200	1,140 404 500	1,140 424 525	1,140 445 551	1,140 467 579
	- Stone crusher	84.09	Unit	590 18 100	590 18 100	590 20 110	590 22 122	590 25 134

(Annex Table 21 continued)

ISIC	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
	- Concrete mixer	84.09	Unit	2,000	2,000	2,000	2,000	2,000
				1,200	1,200	1,300	1,430	1,570
				1,300	1,500	1,650	1,800	1,900
	- Compactor plate	84.09	Unit	500	500	500	500	500
				400	400	440	480	520
				450	500	550	600	660
	- Wheel loader	84.09	Unit	335	335	335	335	335
				-	-	134	201	300
				270	300	335	360	400
	- Motor grader	84.09	Unit	265	265	265	265	265
				-	-	106	159	239
				120	150	188	234	293
	- Excavator	84.09	Unit	450	450	450	450	450
				-	-	180	279	405
				395	490	579	683	806
	- Buldozer	84.09	Unit	1,240	1,240	1,240	1,240	1,240
				-	-	496	744	1,116
				1,360	2,000	2,140	2,280	2,420
38312	Electric motor industry:							
	- Electromotor	85.01	Piece	16,830	17,000	18,700	20,500	22,627
				1,470	5,530	5,710	5,990	6,290
				456,065	501,670	551,830	607,020	667,720
38313	Transformer industry:							
	- Transformer	85.01	Piece	9,350	9,350	10,285	11,310	12,440
				4,964	5,450	5,990	6,590	7,250
				5,660	6,620	7,280	8,010	8,820
38314	Electric panel and switch gear industry:							
	- Electric panel	85.01	Piece	15,600	17,160	18,876	20,750	22,825
				10,656	11,840	12,430	13,050	13,700
				64,166	70,580	77,640	85,400	93,940

(Annex Table 21 continued)

ISIC	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
38316	Other electrical machinery industry:							
	- Generator and generator set	85.01	Piece	62,520	62,575	68,830	75,710	83,280
				26,357	29,080	31,990	35,190	38,610
				50,383	55,420	60,960	67,050	73,750
38321	Radio, TV, entertainment electronic equipment and accessories industry:							
	- Colour TV set	85.15.219	Set	700,000	700,000	700,000	700,000	700,000
				225,000	275,000	315,000	342,000	371,000
				300,000	318,000	340,000	360,000	380,000
	- Black & white TV set	85.15.221	Set	1,400,000	1,400,000	1,400,000	1,400,000	1,400,000
				425,000	468,000	514,000	566,000	622,000
				650,000	690,000	732,000	775,000	822,000
	- Radio/radio cassette		Set	4,950,000	4,950,000	4,950,000	4,950,000	4,950,000
				1,590,000	1,750,000	1,925,000	2,115,000	2,326,000
				1,750,000	1,855,000	1,966,00	2,084,000	2,189,000
	- Cassette record	92.11.931	Set	781,500	781,500	781,500	781,500	781,500
				355,900	392,000	430,000	474,000	521,000
				390,000	415,000	440,000	465,000	493,000
	- Amplifier	92.11.990	Unit	143,000	143,000	143,000	143,000	143,000
				12,600	13,900	15,300	16,800	18,500
				14,000	14,900	15,700	16,700	17,000
	- Cassette Deck	85.14.130	Set	41,000	41,000	41,000	41,000	41,000
				22,100	24,500	27,000	29,500	32,500
				24,000	25,500	27,000	28,500	30,000
	- Loudspeaker	85.14.120	Unit	2,368,000	2,368,000	2,368,000	2,368,000	2,368,000
				1,035,000	1,100,000	1,163,000	1,233,000	1,307,000
				1,115,000	1,182,000	1,253,000	1,328,000	1,408,000
	- Car radio	85.15.319	Set	126,000	126,000	126,000	126,000	126,000
				69,000	73,000	77,500	82,000	87,000
				75,000	79,500	84,500	89,500	95,000

(Annex Table 21 continued)

ISIC	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
38322	Communication equipment industry:							
	- Telephone set[a]	85.13	Unit	40,300 32,000 90,000	40,300 40,000 100,000	46,300 46,000 115,000	53,200 53,000 132,000	61,200 61,000 152,000
	- Radio mobile [a] telephone	85.15.400	System (base/ mobile)	20/4,000 10/2,000 40/8,000	20/4,000 15/3,000 50/10,000	23/4,600 20/4,000 60/12,000	26/5,200 23/4,600 70/14,000	30/6,000 26/5,200 80/16,000
	- Rural telephone[a]	85.13	System (base/ subs)	30/1,500 15/750 50/2,500	30/1,500 20/1,000 60/3,000	30/1,500 23/1,150 70/3,500	30/1,500 26/1,300 80/4,000	35/1,750 30/1,500 90/4,500
	- Central telephone (Analog)	85.13.113	Line Unit	40,000 22,000 45,000	40,000 25,000 50,000	40,000 29,000 57,000	40,000 33,000 66,000	40,000 38,000 76,000
	- Small earth satellite	-	Unit	130 50 50	130 50 50	130 60 60	130 65 65	130 70 70
	- High frequency - Single side band	-	Unit	3,500 950 2,250	3,500 1,050 2,500	3,500 1,150 3,000	3,500 1,250 3,500	3,500 1,400 4,000
	- Very high frequency/ Ultra high frequency Single channel	-	Unit	5,500 1,400 2,000	5,500 1,550 2,500	5,500 1,800 3,000	5,500 1,950 4,500	5,500 2,200 5,000
	- TV relay station	-	Unit	600 50 100	600 70 120	600 90 130	600 100 140	600 120 150
	- Radio Broadcast	-	Unit	100 10 100	100 30 100	100 50 110	110 75 120	120 100 130

(Annex Table 21 continued)

ISIC	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 Capacity -Production -Demand
	- Radio transmitter	-	Unit	50	50	50	50	50
				-	10	15	30	40
				30	30	35	40	45
	- Multiplex		Channel	5,000	5,000	5,000	5,500	6,000
				-	2,500	3,000	3,500	4,000
				6,000	6,000	6,000	6,500	7,000
	- Radio head		System	200	200	250	300	350
				100	150	200	250	300
				350	375	400	425	450
	- Radio and wind sender/ transmitter		Unit	15,000	15,000	15,000	15,000	15,000
				2,000	2,500	3,000	3,500	4,000
				5,000	6,000	7,000	8,000	9,000
	- PABX a/		Line	36,500	36,500	42,000	48,000	55,000
			Unit	-	36,000	41,500	47,500	55,000
				80,000	90,000	100,000	120,000	135,000
38330	Household electrical equipment industry:							
	- Refrigerator	84.15.391	Unit	340,000	340,000	340,000	340,000	340,000
				153,000	162,000	172,000	182,000	193,000
				161,000	171,000	181,000	192,000	203,000
	- Air conditioner	84.15.310	Unit	142,000	142,000	142,000	142,000	142,000
				55,000	58,300	61,800	65,500	69,500
				57,500	61,000	65,000	68,500	73,000
	- Fan	85.06.219	Unit	878,000	930,000	987,000	1,045,000	1,108,000
				756,000	801,000	849,500	900,500	955,000
				815,000	864,000	916,000	971,000	1,029,000
	- Electric iron	85.12.400	Unit	550,000	550,000	550,000	550,000	550,000
				33,700	35,700	37,900	40,200	42,500
				35,500	38,000	40,000	42,500	44,800

ISIC	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
	- Rice cooker	85.12.520	Unit	53,200 49,000 51,500	58,500 52,000 55,000	64,500 55,000 58,000	70,800 58,500 61,500	78,000 62,000 65,000
38394	Electric and telephone cable industry:							
	- Electric cable	85.23.110	Ton	53,170 40,000 70,000	56,500 42,500 80,500	60,000 45,000 92,500	63,500 47,500 106,500	67,000 50,500 122,500
	- Telephone cable	85.23	Ton	8,000 7,000 14,000	8,500 7,500 16,000	9,000 8,000 18,500	9,500 8,500 21,500	10,000 9,000 24,500
38411	Shipbuilding and shipyard industry:							
	- New ship	89.01						
	- up to 500 GRT		GRT	33,650 - -	33,650 26,920 19,047	33,360 26,920 11,761	33,650 26,920 20,490	33,650 48,456 30,142
	- from 501 to 2,000 GRT		GRT	40,600 - -	40,600 28,420 40,353	40,600 28,420 44,461	40,600 28,420 47,801	40,600 55,216 52,570
	- from 2,001 to 5,000 GRT		GRT	19,500 - -	19,500 11,700 29,682	19,500 11,700 31,245	19,500 11,700 32,696	19,500 20,280 44,041
	- from 5,001 to 10,000 GRT		GRT	13,000 - -	13,000 6,500 15,301	13,000 6,500 15,658	13,000 6,500 16,044	13,000 9,100 21,464
38414	Ship repairs industry:							
	- Ship repairs	89.						
	- up to 500 GRT		GRT	16,048 - -	16,048 160,319 198,131	16,048 160,319 208,505	16,048 160,319 217,500	16,048 180,540 230,768

(Annex Table 21 continued)

ISIC	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
	- from 501 to 2,000 GRT		GRT	13,940	13,940	13,940	13,940	13,940
				-	119,332	119,332	119,332	139,380
				-	385,850	411,727	439,680	492,200
	- from 2,0001 to 5,000 GRT		GRT	12,920	12,920	12,920	12,920	12,920
				-	110,595	110,595	110,595	119,380
				-	271,007	295,896	328,996	362,107
	- from 5,001 to 10,000 GRT		GRT	8,840	8,840	8,840	8,840	8,840
				-	75,670	75,670	75,670	81,682
				-	227,454	248,868	267,971	295,291
	- from 10,001 to 30,000 GRT		GRT	42,160	42,160	42,160	42,160	42,160
				-	316,200	316,200	316,200	337,280
				-	1,317,838	1,393,335	1,462,511	1,560,212
38421	Railway, parts and train accessories industry:							
	- Frieght car	86.07.000	Piece	300	300	600	600	600
				50	300	512	512	512
				800	900	950	994	1,000
	- Passenger car[a]	86.05.000	Piece	-	-	50	50	50
				-	-	50	50	50
				168	173	188	195	208
	- Diesel rail[a]	86.03.120	Piece	-	-	-	-	-
				-	-	-	-	-
				16	20	26	32	36
	- Electric rail[a]	86.02.000	Piece	-	-	-	-	-
				-	-	-	-	-
				27	36	44	51	55
	- Locomotive[a]	86.03.110	Piece	-	-	-	-	-
				-	-	-	-	-
				36	45	55	60	65

ISIC	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
38431	Four- or more wheel motor vehicle industry:							
	- Passenger vehicle	87.02.221	Unit	52,515	52,515	52,515	52,515	52,515
				29,710	34,170	39,290	45,180	51,950
				29,710	34,170	39,290	45,180	51,950
	- Commercial vehicle	87.02	Unit	297,585	297,585	297,585	297,585	297,585
				196,550	226,070	259,940	297,585	297,585
				196,550	226,070	259,940	298,930	343,770
38432	Four- or more wheel motor vehicle equipment and body industry:							
	- Fuel engine	-	Thousand units	-	-	-	425	425
				-	-	-	36.5	149.2
				81.0	92.4	103.0	114.9	128.1
	- Diesel engine[a/]	-	Thousand units	-	-	185.5	185.5	185.5
				-	-	77.0	85.0	94.0
				83	85.9	87.2	97.2	108.4
	- Cabin	-	Thousand units	149.6	149.6	149.6	149.6	149.6
				94.9	105.0	115.0	126	139.0
				145.5	165.5	184.6	205.8	229.5
	- Chassis/frame	87.061.60	Thousand units	178	178	178	178	178
				94.9	105	115	126	139
				140	178.0	198.5	221.3	246.8
	- Axle[a/]		Thousand units	-	-	-	294	294
				-	-	-	256.6	286.2
				180	206.4	230.2	256.6	286.2
	- Transmission[a/]		Thousand units	-	-	-	-	-
				-	-	-	-	-
				155.0	178.0	198.5	221.3	246.8
	- Propeller shaft[a/]	-	Thousand units	-	-	-	264	294
				-	-	-	221.3	246.2
				151.0	178.0	198.5	221.3	246.2

ISIC	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
	- Rear body[a]		Thousand units	137.6	137.6	137.6	137.6	137.6
				99.7	105.6	117.9	137.4	137.6
				97.7	105.8	117.9	131.4	146.6
38451	Aeroplane and accessories industry:[b]							
	- Aeroplane (fixed wing)							
	- C.212		Unit	24	24	24	24	24
				12	15	16	18	24
				30	32	34	36	38
	- CN.235		Unit	-	-	11	11	11
				-	-	1	3	7
				-	-	15	20	25
	- Helikopter							
	- BO-105		Unit	36	36	36	36	36
				12	17	18	20	22
				5	20	22	24	26
	- Puma		Unit	12	12	12	12	12
				7	6	7	8	10
				-	-	-	-	-
	- BK 117		Unit	-	-	18	18	18
				-	-	1	6	10
				14	16	18	20	22
38131	Prefabricated metal building material industry except aluminium:							
	- Steel construction	73.32.220	Ton	25,000	28,000	36,000	47,000	60,000
				17,500	25,000	32,500	43,000	55,000
				64,000	70,750	77,820	85,000	94,000
	- Steel tank	73.40.390	Ton	11,097	16,000	21,000	28,000	35,000
				8,145	15,930	21,000	28,000	35,000
				54,000	42,000	46,000	51,000	56,000

ISIC	Commodity	CCCN	Unit	1982/1983 -Capacity -Production -Demand	1983/1984 -Capacity -Production -Demand	1984/1985 -Capacity -Production -Demand	1985/1986 -Capacity -Production -Demand	1986/1987 -Capacity -Production -Demand
	- Boiler	73.37.000	Ton	10,200	10,200	10,200	10,200	10,200
				3,105	4,000	5,200	7,000	9,000
				14,000	16,000	18,000	20,000	22,000
	- Material handling	73.27.400	Ton	3,800	3,800	4,500	5,400	6,500
		73.29.190		3,800	3,800	4,500	5,400	6,500
		73.16.210		10,200	11,300	12,400	13,600	14,900
	- Milling equipment	84.10.100	Ton	3,000	3,000	3,500	4,200	5,000
		84.10.200		1,000	2,000	3,500	4,200	5,000
		84.10.300		8,200	9,000	9,700	10,900	12,000
	- Pumps	84.10.100	Ton	-	500	1,000	1,200	1,500
		84.10.200			500	1,000	1,200	1,500
		84.10.300			8,400	9,300	10,200	11,000
	- Other standard equipments	-	Ton	1,000	1,000	1,000	1,300	1,600
				700	700	1,000	1,300	1,600
				1,200	1,400	1,600	1,800	2,000

Source: The Development of National Capacity in Industry for 1983-1986, Summary, Ministry of Industry, Republic of Indonesia, 1983 (unofficial translation).

Notes: a/ New investment/development.
b/ Production and demand depend upon orders.

Part Two. Long-term Projections of Demand for Capital Goods

Part Two. Long-term Projections of Demand for Capital Goods

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Part Two. Long-term Projections of Demand for Capital Goods in Indonesia

Summary

Capital goods are required to produce consumer, intermediate or other capital goods. For any technology, a particular stock of fixed capital (e.g. machines) is required to produce a particular annual flow of output of finished products.

In this part an attempt is made to forecast future demand for capital goods in Indonesia. The forecast covers the demand for a selected group of capital goods by product for the years 1985, 1990 and 2000 on alternative hypotheses about the rates of growth of GDP and sectoral shares.

The problem is approached in two stages. In the first stage forecasts of major macroeconomic variables at a highly aggregative level are generated for the economy. On this basis the second stage attempts detailed forecasts of the demand for capital goods.

The approach adopted makes use of the available time series data on capital goods imports, production and exports and sectoral value added. The demand for capital goods, calculated as production plus imports minus exports, is related to changes in value added in the appropriate capital using sector or sectors. This procedure implies econometric estimation of incremental capital-output ratios for capital goods sector disaggregated in relatively great detail (61 categories of Division 7 of SITC Rev. 1). Annual observations over the period 1967-1978 were used to estimate the demand equations. Most of the equations proved to be statistically significant and adequate for the forecasting exercise.

Time series extrapolations were used to forecast GDP and sectoral shares. The time series procedure was broken down into steps. In the first step forecasts were generated for oil and non-oil GDP, taking into account the impact of oil and LNG revenues on both components of GDP. Three alternative forecasts, based on alternative assumptions about future oil revenues were generated. These forecasts are denoted High, Medium and Low. In the second step, sectoral shares of non-oil sectoral shares by the forecast of non-oil GDP in order to obtain forecasts of non-oil sectoral GDP levels.

To use the forecasting equations oil reveneus had to be forecasted. The period of the 1970s saw rapid increases in oil revenues in Indonesia. However, the early 1980s have been characterized by falling demand for OPEC oil and falling nominal oil prices. The basic assumption made here is that the world oil market will recover by 1985, as the world economy recovers from the severe recession which began in 1981, but continues to expand thereafter. The three assumptions made about the rate of expansion after 1985 describe the "High", "Medium" and "Low" growth scenarios. Oil production in mbd was forecast to increase from a level of 1.34 in 1983 to 1.65 in 1985, 1.9 in 1990 and 2.0 in the year 2000. Three alternative assumptions were made concerning oil prices. In the "Low" scenario the oil price was held constant at US$ 28 per barrel for the entire forecasting period. In the "Medium" scenario the oil price rises to US$ 34 in 1987 and continues to increase at US$ 2 per year until 2000. In the "High" scenario the oil price is US$ 32 in 1985, US$ 52 in 1990 and US$ 75 in 2000.

Two sets of share forecasts were generated. The first set was based on an extrapolation of historical data and thus is referred to as the "Trend" forecasts. The second set of share forecasts modified the trend forecasts to take account of official development plans for increased frowth of the manufacturing sector. This set of share forecasts is referred to as the "Off-trend" forecasts.

Six sets of sectoral GDP forecasts were thus produced. Combination of trend and off-trend shares with high GDP level forecasts gives the high-trend (HT) and high off-trend (HO) sectoral GDP forecasts, etc.

Total demand for non-electrical machinery in Indonesia was US$ 1.9 billion in 1980. In 1985, the lowest historical projection puts at US$ 3.6 billion in constant 1980 dollars. Under off-trend postulates it could reach US$ 4.3 billion. In 1990, both the trend and the off-trend forecasts indicate a substantial increase in the demand in capital goods with non-electrical machinery demand rising to US$ 8.2 billion under the trend forecast and to US$ 11.7 billion under off-trend conditions. These demands rise almost exponentially throughout 1990s. Thus, there exists a strong demand for capital goods in Indonesia to substantiate a major effort to produce these goods locally.

Chapter I. Some Theorectical Considerations

All economic forecasting is difficult, and forecasting the demand for capital goods particularly so.

Capital requirements and investment. The first point to note is the distinction between "needs" and effective demand, between capital (goods) requirements and actual investment. Investment decisions are influenced by a variety of factors, psychological ones such as business confidence in the case of private investors and planning errors in the case of public investment, as well as cost and availability of finance, which cause the rate of investment to be only loosely related to capital requirements, certainly in its timing. Even were it possible to forecast capital requirements reasonably accurately, therefore, this would not necessarily provide precise guidance on the flow of orders to the capital goods producing industry and to the capacity needed in that industry in any short period.

The acceleration principle. Capital goods are required to produce consumer, intermediate or other capital goods. For any given technology, a particular stock of fixed capital (e.g. machines) is required to produce a particular annual flow of output of finished products. This relationship underlies the acceleration principle according to which the rate of investment (i.e. of additions to the stock of capital) is a function of the increase of output of finished products,

$$I = (\triangle K) = f\,(Y_{t+1} - Y_t)$$

where I is the rate of investment, K the capital stock and Y the level of output or income.

The investment determined by the acceleration principle is only one component of total investment. Another component is inventory investment. The capital stock consists of fixed capital and stocks or inventories (of raw materials, work in process and finished products awaiting sale). Since inventory investment does not involve capital goods, this component can be ignored here. A third component is replacement investment, to make good depreciation and obsolescence of the existing stock of fixed capital. This component clearly cannot be ignored, since the demand for capital goods in any period is the sum of demand for expansion of existing capacity, or net investment (as determined by the acceleration principle), and replacement investment. It is gross fixed capital formation, net investment plus replacement investment, that determines the demand for capital goods. Forecasting the demand for capital goods, therefore, requires estimates of future demand for both net investment and replacement investment.

Net Investment. The coefficient in the above equation which relates the increase in capital stock required to sustain a given increase in output or income to that increase is sometimes called the incremental capital-output ratio (ICOR). It is possible to make statistical estimates over some past period of the ICOR for a whole economy or for particular sectors (such as agriculture or manufacturing) or sub-sectors (such as the textile or engineering industries). What determines the ICOR (interpreted in terms of capital requirements rather than actual investment)?

In any given capital-using activity, the ICOR is determined, in the first instance, by the method of production or "technology". The more capital-intensive the method of production, the higher, cet. par., will be the ICOR. A high ICOR does not, in itself, say anything about the economic efficiency or inefficiency of the industry. Whether a high ICOR is efficient depends on relative factor prices; it will be efficient to use capital-intensive technology if labour is relatively expensive (and capital cheap) but not if labour is plentiful (cheap) and capital scarce (expensive). A high ICOR may, however, be an indication of inefficient use of the existing capital stock. The extra output obtained from a given increase in capital stock may be relatively small, either because the capital stock remains underutilised or because of other sources of inefficiency (most of which derive from under-utilisation or inappropriate use of capital or labour). One determinant of the ICOR, therefore, is the efficiency with which capital is used (since, appropriately defined, the ICOR is the reciprocal of the marginal productivity of capital).

Since different industries (and different firms within industries) employ widely different methods of production (with different degree of capital intensity) and employ their capital and labour with different degrees of efficiency, there will evidently be considerable differences between statistically estimated average ICORs for different industries in any given past period and probably also in different past periods. Estimates of average ICORs for whole national economies vary generally between 3 and 6. ICORs for different industry branches range from 1 or less in relatively labour-intensive manufacturing industries to as high as 8-10 for very capital-intensive industries.

Replacement investment. Capital equipment wears out, through time and use. Each piece of capital equipment, therefore, has a certain physical life-span which can be measured by a rate of depreciation. Replacement investment is required to make good depreciation. (Current expenditure on repair and maintenance may prolong the life of a machine, so that there is some trade-off between current and capital expenditure). In addition to the effects of time and use, there is the effect of technical change. Some of the existing fixed capital stock may be rendered obsolete or uneconomic to use because a new type of equipment, embodying new technolgy, makes it possible to produce the same output (quality for quality) at lower cost, allowing for the capital charges on the new equipment.

While the rate of replacement of any given piece of equipment is determined by the rate of depreciaton and obsolescence, the rate of required replacement investment in a whole industry is also determined by the average age of its capital stock. If much of it is of recent vintage, the rate of required replacement in the near future will be relatively low, and vice versa.

Aggregate demand. If the task is to estimate demand for capital goods in the economy as a whole, not merely for individual capital-using industries, there remains the further problem of forecasting future rates of growth of demand for the final products of the whole range of capital-using industries. The methodological problems are familiar but formidable. In a closed economy, the problem can be stated formally in terms of forecasting the rate of growth of GDP and income (or output) elasticities of demand for the various categories of final product. In an open economy, allowance must also be made for that part of the domestic demand for each category that is expected to be met by imports and the addition to domestic demand likely to be made by exports.

Determinants of demand for capital goods. The purpose of the preceeding brief exposition has been to identify the elements that must enter into any estimates of future demand for capital goods.

To estimate future demand for net investment, it is necessary to estimate (a) future growth of output of finished products and (b) the relevant ICORs. Future growth of output will depend on future growth of domestic demand for the product, less that part of doemstic demand that is met by imports, plus demand for export. The relevant ICORs will depend on the average capital intensity and average efficiency of resource use among the firms of an industry sub-sector or among the sub-sectors of an industry branch. To estimate demand for replacement investment, it is necessary to estimate the future rate of depreciation and obsolescence and the average age of the capital stock of industries and branches.

For all these variables it may be possible to obtain statistical data for some past period, although this cannot be taken for granted. It is another matter to project from such past experience into the future. Various econometric techniques exist for doing so, from simple extrapolation of time series to more sophisticated estimation on the basis of assumed functional relationships. But it is clear that a very large margin of error necessarily attaches to any such estimates, whatever the technique used.

If the ultimate purpose of estimates of future demand for capital goods is to guide planning for the establishment of domestic capital goods (producing) industries, precise estimates of future demand for capital goods are not really necessary for an open economy. Domestic demand can be met by imports and supplemented by exports. All that is needed, therefore, for each type of capital good is to determine, as far as possible, whether (a) domestic demand is likely to be sufficient for economically efficient (optimum scale) domestic production and, if not, (b) whether there are prospects for export sufficient to enable domestic production to reach this volume; and (c) whether domestic production is likely to be competitive with imports, subject to some maximum rate of effective protection (say, 20 or 30 per cent).

The purpose of the following chapters is to provide an economic study of future demand for capital goods in Indonesia. The forecast covers the demand for a selected group of capital goods by product for the years 1985, 1990 and

2000 under alternative hypotheses about the rates of growth of GDP and sectoral shares. These forecasts are to be used in formulating a strategy for domestic capital goods production.

Chapter II. The Methodology Underlying the Indonesian Capital Goods Forecasts

2.1 General Framework

The objective is to provide forecasts of the demand for capital goods (the 61 categories of "engineering products" included in the published data for the SITC category 7). Demand is calculated as production plus imports minus exports. As such, it represents domestic demand only.

Ideally, these forecasts should be generated by comprehensive, consistent, and detailed models for each industry, which are then integrated into a model of the country. However, a model of this type capable of generating forecasts of the demand for capital goods at the level of detail desired in this study would have to be very large. Models of this type are rarely found, even in the major developed countries. For example, Informetrica, a private consulting firm in Ottawa, maintains a 3,000 equation model of the Canadian economy which, despite its large size, does not provide the detailed forecasts envisioned in this study. It is clear that, such as approach would be inappropriate. A much more practical approach, adopted here, is to attack the problem into two stages. In the first stage forecasts of major macroeconomic variables at a highly aggregated level are generated for the economy. In the second stage, detailed forecasts of demand for capital goods are based on the much less detailed forecasts of macroeconomic variables. Since the macroeconomic variables which are generated in the first stage must fit into the second stage, we will discuss the second stage first.

2.2 The Forecasts of the Demand for Capital Goods

2.2.1 The Conceptual Framework

Capital goods imports are of primary concern because there is very limited production of most capital goods in Indonesia. This fact has two implications. The first is that possibilities for increased domestic production of capital goods (import substitution) should be of primary concern. This provides the basic orientation of this study. The second implication is much more practical; namely, that for many products imports can be viewed as identical to total demand. For products where there is production of capital goods and/or exports the commodity balance equation was used to generate the apparent demand. Thus, our forecasts can be interpreted as forecasts of demand for the capital goods considered in the study.

What, then, is the most appropriate method for forecasting the demand for specific capital goods in Indonesia? Some of the classifications are narrowly defined so that the capital goods can be identified with one particular sector; for example, pulp and paper machinery (SITC 718.1). Others are not specific to particular sectors, being broadly used throughout the economy, such as machine tools (SITC 715.1). Where possible, it would seem desirable to relate the demand for specific capital goods to economic variables relevant to the using sector or sectors. The major difficulty in this regard is the absence of readily available time series data on economic activity at a detailed sectoral level in Indonesia. Two input-output studies have been completed, but these provide two observations only. There are no time series data on the price of output by sector, on input prices by sector, or on investment or capital stock by sector, although some of these variables might be constructed from other available data. Thus the scarcity of relevant data is a significant constraint on the preparation of these forecasts.

A second important consideration is the nature of the choice of sectoral investments in these countries. In Indonesia the Government has a substantial impact on both the overall quantity and the sectoral pattern of investment. This impact may be direct through investment by public agencies, or indirect through licensing (control) of private investment through BKPM, or the allocation of loans to finance investment. The impact of Government on the decisions to use and import capital goods in Indonesia is more decisive than the impact of private decisions.

The above considerations rule out the use of a neo-classical framework which attempts to explain investment in terms of profitability. Considerations of profitability based on the prices faced by the private sector may not be appropirate if goverment decisions and plans are based on other criteria, such as the social opportunity costs of inputs or the externalities generated by the development of capital goods industries. The above argument may suggest a planning model framework, to explain government decisions; but, as indicated in the introduction to this chapter, the detailed application of that approach is beyond the scope of this project. Equally compelling factors in the decision not to follow either of the above approaches are the absence of the detailed time series data required to implement the neoclassical approach and the detailed structural data required to implement the planning approach.

The approach adopted makes use of the available time series data on capital goods imports, production and exports and sectoral value-added. Here demand for capital goods are related to changes in value-added in the appropriate capital-using sector or sectors.[1/] We interpret this procedure as the econometric estimation of incremental capital-output ratios where the capital goods are disaggregated in relatively great detail (the 61 available SITC categories) while the outputs are more highly aggregated (the 8 sectoral breakdown of GDP). This interpretation is strictly valid only if the ratio of value-added to the value of output remains constant over time.[2/] This may not be the case if other inputs are withdrawn from the using sector. In these circumstances we would not be able to estimate incremental capital-output ratios, which are based on the assumption of a fixed coefficient technology.

Some of the "engineering products" are clearly durable consumer goods, such as passenger motor cars (732.1) and therefore are excluded in this study.Other categories, such as ships and boats (735) or sewing machinery (717.3) may include both capital goods and/or consumer goods. For these products, a consumer demand equation may be an appropriate basis for forecasts. Such an equation has been used for these products, using the current level of GDP (in current Rupiah) as a proxy for consumer income.

Even for products which are clearly capital goods, the use of the current level of GDP as the basis for forecasts may be justified. GDP can be interpreted as representing the ability of a country to import. (This measure may be crude but the lack of data precludes more sophisticated measures). Under this interpretation the current level of GDP determines the level of imports of capital goods which in some cases represents the entire demand for a given capital goods, which in turn determines the changes of sectoral GDP in the future.

2.2.2 The forecasting equations

The forecasts of demand for specific capital goods were computed using an equation of one of the following forms:

$$(1)\ D_{it} = a_0 + a_1(GDP_{j,t+1} - GDP_{j,t}) + a_2(GDP_{j,t+2} - GDP_{j,t+1})$$

where D_{it} is the value of demand for capital goods i in period t and $GDP_{j,t}$ is the value-added in sector j in period t.[3/]

or

$$(2)\ D_{it} = a_0 + a_1\ GDP_t$$

where GDP_t is the current level of GDP.

Because some product categories are aggregates, such as construction and mining machinery (SITC 718.4), or include products which may be used in several sectors, such as pumps (SITC 719.2), the identification of the using sector cannot be based solely on a priori engineering judgement. For such products equations were estimated for each potential using sector.

The above equations were estimated using annual observations over the period 1967-1978. The estimation period could not be extended past 1978 as the GDP data must be available for two years after the end of the estimation period. The limited number of observations available made it impossible to introduce any longer lags between the demand for capital goods and changes in output. Each additional lag uses up two degrees of freedom, one for the additional parameter introduced and one for data point lost. Demand and GDP could be measured either in current or constant prices, since the demand data can be converted to constant prices using a price index for capital goods from the supplying countries and GDP data are available in both current and constant Rupiah. The results when current price data were used were superior to those obtained using constant data.[4/] Thus, it was decided to use current price values for all variables in the forecasting equations.[5/] The demand data were obtained from U.N. and domestic (BPS) sources, whereas the GDP data were obtained from the U.N. Statistical Yearbook for the Far East and Asia. For capital goods U.S. dollar values were used, since the prices of these goods are primarily determined in supplying countries. GDP data was measured in domestic currency (Rupiahs), since this most accurately reflects changes in domestic activity. Several major devaluations over the data period have altered the US dollar/Rupiah conversion, so that changes in GDP measured in US dollars do not reflect changes in domestic activity.

There are several reasons why the relationships measured by the above equations might change over time, leading to errors in the forecasts. Firstly, the nature of technology may change so that the same sector uses a different mix of capital goods. Secondly, the mix of industries within a sector may change over time, having the same result. Finally, the price of the capital good may change relative to the price of output of the using sector. These potential biases in the forecasts are difficult to evaluate because we have no historical data describing the relationships in question.

The forecasting equations are described in Table II.1. Coefficient estimates, R^2 values, and Durbin-Watson statistics (D.W.) are presented and the using sector or sectors are identified. (The sectoral numbering scheme is described in Appendix Table 1.) These equations will be discussed in the following section.[6/]

Table II.1: The forecasting equations

Products	Coefficient Estimates (a_0)	(a_1)	(a_2)	D.W.	R^2	GDP Components
Total Engineering Products 7	231.813	0.001538	.002433	1.83	.78	GDP3
Total Machinery non-electric 71	93.9861	.000761	.001096	1.81	.76	GDP3
Total Electrical Machinery 72	91.9756	.0000199	-	.68	.76	GDP (current level)
Power Generating Machinery 711	31.5118	.0001307	.0001949	2.0	.64	GDP3
Boiler, Steam Generating Machinery 711.1	-2.96117	.0000019	-	2.55	.90	GDP (current level)
Steam Engines 711.3	1.60648	.000027	-.0000036	2.44	.41	GDP3
Aircraft Engines 711.4	.301452	.00000022	-	1.23	.34	GDP (current level)
Other Internal Combustion Engines 711.5	-3.82251	.0000097	-	1.08	.77	GDP (current level)
Nuclear Reactors 711.7	.763494	.000157	-	2.44	.76	GDP4
Engines, nes 711.8	-47.4401	.000289	-.0000271	2.47	.71	GDP3
* Agricultural Machinery 712	11.8243	.0000113	-	1.45	.16	GDP (current level)
Office Machinery 714	3.37534	.00000091	-	1.19	.90	GDP (current level)
Typewriters 714.1	1.12701	.000000327	-	2.23	.93	GDP (current level)

Table II.1 (continued)

Products	(a_0)	(a_1)	(a_2)	D.W.	R^2	GDP Components
Office Machines, nes 714.9	1.71982	.000000102	-	.99	.71	GDP3
Metal Working Machinery 715	2.59641	.0000676	-.00000247	2.10	.76	GDP3
Machine Tools 715.1	.147325	.0000595	-.00000416	2.95	.51	GDP3
Textile and Leather Machinery 717	24.3762	.00008638	.00009937	1.46	.70	GDP3
Textile Machinery 717.1	-3.27485	.000291	-.00000326	1.00	.75	GDP3
Skin, Leather Working Machinery 717.2	-.688028	.000000105	-	3.34	.98	GDP (current level)
Sewing Machinery 717.3	1.15705	.00000068	-	1.36	.95	GDP (current level)
Special Industrial Machinery 718	19.9178	.0001623	.0001853	1.74	.75	GDP3
Paper and Pulp Machinery 718.1	-3.12895	.00000063	-	1.58	.86	GDP (current level)
Food Processing Machinery 718.3	4.98328	.0000159	.0000127	1.10	.43	GDP3
Construction, Mining Machinery 718.4	13.7734	.000005135	-	1.20	.89	GDP (current level)
Mineral and Glass Working Machinery 718.5	4.54722	.0000557	-	1.63	.51	GDP3
Other Special Machinery 719	11.8940	.0003296	.0005347	1.75	.79	GDP3

Table II.1 (continued)

Products	(a_0)	(a_1)	(a_2)	D.W.	R^2	GDP Components
Heating, Cooling Equipment 719.1	3.88216	.0000528	.0000957	1.91	.70	GDP3
Pumps and Centrifuges 719.2	5.65528	.00006265	.0000876	1.50	.79	GDP3
Mechanical Handling Equipment 719.3	-1.59283	.0000605	.0000902	1.40	.78	GDP3
Powered Tools, Other 719.5	11.6129	.0000407	-.0000132	1.82	.72	GDP5
Spraying, Vending Other Machinery 719.6	1.64850	.0000256	.000028	1.42	.85	GDP5
Ball, Roller Bearings 719.7	1.45242	.0000003	-	3.17	.93	GDP (current level)
Machinery and Mechanical Appliances, nes 719.8	16.1207	.0000348	.0000954	1.77	.85	GDP3
Parts and Accessories of Machinery, nes 719.9	-9.85155	.0000634	.0001039	1.71	.68	GDP3
Electrical Power Machinery 722	13.1268	.000007338	-	.72	.85	GDP (current level)
Power Transforming Machinery 722.1	18.2241	.00000564	-	.64	.79	GDP (current level)
Switchgear, etc. 722.2	1.33627	.00000192	-	.95	.85	GDP (current level)
Equipment for Distributing Electricity 723	11.3279	.00000353	-	.72	.86	GDP (current level)

Table II.1 (continued)

Products	(a_0)	(a_1)	(a_2)	D.W.	R^2	GDP Components
Insulated Wire and Cable 723.1	11.9265	.0000031	-	.70	.84	GDP (current level)
Electric Insulated Equipment 723.2	-3.90489	.000000695	-	2.56	.88	GDP (current level)
Electrical Machinery Other 729	18.6848	.00000442	-	1.49	.77	GDP (current level)
Batteries and Accumulators 729.1	10.9191	.00000169	-	1.26	.95	GDP (current level)
Electric Lamps 729.2	-.398094	.000000497	-	1.29	.91	GDP (current level)
Valves, Tubes, etc. 729.3	-3.4687	.000000606	-	1.71	.81	GDP (current level)
Automotive Electrical Equipment 729.4	1.15065	-.00000332	.0000434	1.79	.78	GDP6
Measuring Apparatus 729.5	-22.0655	.000134	-.0000152	3.20	.49	GDP3
Electro-Mechanical Hand Tools 729.6	-.812592	.00000911	-	2.62	.60	GDP3
Other Electrical, nes 729.9	-1.92848	.0000507	.0000715	2.10	.94	GDP5
Railway Vehicles 731	-1.27096	.000095	.0000475	.92	.59	GDP6
Locomotives, Other 731.3	-1.32654	.0000095	.000035	1.87	.70	GDP6
Passenger: Railway, Tramway Cars 731.5	.581687	.0001777	-.0000776	1.45	.61	GDP6

Table II.1 (continued)

Products	(a_0)	(a_1)	(a_2)	D.W.	R^2	GDP Components
* Railway, Locomotive Car Parts, next 731.7	2.12409	.0000038	-	1.90	.11	GDP6
* Buses 732.2	15.7461	.00002	-	2.06	.05	GDP6
Lorries and Trucks 732.3	-40.4429	.000446	.000878	1.25	.85	GDP6
Special Purpose Lorries, Trucks and Vans 732.4	2.78519	.000000729	-	1.81	.51	GDP (current level)
* Tractors for Trailers 732.5	10.8994	-.00006694	.00005416	1.00	.25	GDP6
Ships and Boats 735	.995856	.0001677	.000149	1.78	.74	GDP6
Ships and Boats non-war 735.3	-.520072	.0000465	.0000176	1.85	.52	GDP6
Ships and Boats nes 735.9	.0308921	.000145	.0001214	1.82	.65	GDP6

Source: Econometric Research Ltd.

Note: No forecasts were generated for products marked with an *, since the statistical fit of the forecasting equations is poor.

2.3 The Forecasts of Sectoral GDP

2.3.1 The General Framework

In order to use the forecasting equations described in the previous section, forecasts of GDP by sector must be generated. These could potentially be generated with a medium scale econometric model (50-100 equations would be necessary). However, generation of such a model is a major undertaking, particularly when the data required are not readily available. Thus econometric models were not used for this purpose. Instead, time series extrapolations were used.

The time series procedure was broken down into steps. In the first step forecasts were generated for oil and non-oil GDP, taking into account the impact of oil revenues on both components of GDP. Three alternative forecasts, based on alternative assumptions about future oil revenues were generated. (These forecasts are denoted High, Medium and Low.) In the second step, sectoral shares of non-oil GDP were forecast, again based on time series extrapolations. The third and final step was the multiplication of non-oil sectoral shares by the forecast of non-oil GDP in order to obtain forecasts of non-oil sectoral GDP levels.

The short time series precluded any more sophisticated time series procedures.

2.3.2 The GDP Forecasts

It might be argued that relatively simple econometric models could have been used to generate these forecasts. However, these results would be sensitive to forecasts of exogenous variables, particularly the price of oil or oil revenues. Here we relate GDP directly to oil prices, in order to make this dependence explicit.

The historical growth rates of oil, non-oil and total GDP (in current Rupiahs) together with the forecasting equations are presented in Table II.2. In contrast to other OPEC countries, the impact of oil revenues on non-oil GDP has been relatively small (the estimated elasticity is only 0.04).[7] The impact of oil revenues on oil-GDP is predictably high (the estimated elasticity is 0.94). After the impact of oil revenues is taken into account, the trend growth rate of non-oil GDP was 22.7 per cent (in current Rupiah).

Table II.2 Historical growth rates and forecasting equations for oil, and total GDP

A. Historical Growth rates: a/ b/

GDP	Time Period	Growth rate
Oil	1967-1980	43.87
Non-oil	1967-1980	24.87
Total	1967-1980	27.00

B. Forecasting Equations: c/

LN(Oil-GDP) = Ln(a)+b Ln(Oil-Revenue)
LN(Non-oil GDP) = Ln(c)+d Ln(Oil Revenue)+f time

Total GDP = Oil GDP + Non-oil GDP

Coefficient Estimates:

Coefficient	Estimated Coefficient	Standard Error	T Statistic
a	3.17642	1.74860	1.81655
b	0.944862	0.0416108	22.7071
c	681502.0	598649.	1.13840
d	0.0395049	0.0892481	0.442642
f	0.227837	0.0403213	5.65053

Notes: a/ Growth rates were determined from econometric estimates of the following equation:
Ln X_t = a + bt + $_t$
where b is the estimated annual growth rate.
b/ All values are in Current Rupiah.
c/ The above equations were estimated as a system using the full-information maximum likelihood method.

In order to use the above equation systems, forecasts of oil revenues must be made. The period of the 1970's saw rapid increases in oil revenues in Indonesia. However, the early 1980's have been characterised by falling demand for oil and falling oil prices. The basic assumption made here is that the world oil market will recover by 1985, as the world economy recovers from the severe recession which began in 1981, and continue to expand thereafter. Three assumptions are made about the rate of expansion after 1985, leading to the "High", "Medium" and "Low" growth scenarios. Oil production (in million barrels per day) was forecast to increase from a level of 1.34 in 1983 to 1.65

in 1985, 1.90 in 1990 and 2.0 in 2000. (These production forecasts are consistent with World Bank forecasts.) Three alternative assumptions were made concerning oil prices. In the "Low" scenario the oil price was held constant at $ 28 (US per barrel) for the entire forecasting period. In the "Medium" scenario the oil price rises to $ 34 in 1987 and continues to increase at 2 per cent until 2000. In the "High" scenario (based on World Bank forecasts) the oil price is $ 32 in 1985, $ 52 in 1990 and $ 75 in 2000.

The above assumptions concerning oil revenues may appear to be somewhat arbitrary, but they are based on the best judgements of Econometric Research. When the forecast oil revenues are substituted into the forecasting equations in Table II.2, forecasts of Oil GDP, Non-oil GDP and Total GDP (in millions of Rupiah) are generated. (see Appendix)

2.4 Forecasts of Non-oil Sectoral GDP

The forecasts of non-oil sectoral GDP were based on forecast shares of non-oil GDP. Two sets of share forecasts were generated. The first set was based on an extrapolation of historical data and thus is referred to as the "Trend" (or T) forecasts. The second set of share forecasts modified the trend forecasts to take account of official development plans for increased growth of the manufacturing sector. This set of share forecasts is referred to as the "Off-trend" (or O) forecasts.

The trend share forecasts were based on a system of logistic equations whose parameters were estimated from time series data (the estimation periods are the same as those shown in Table II.2). The system of equations is given below:

$$\begin{aligned} S_jT &= A_j / (1+B_j\mathrm{EXP}(-C_{j*}T)) \qquad j = 1, \ldots, 6 \\ S_{7T} &= 1 - \sum_{j=1}^{6} S_{jT} \end{aligned} \tag{3}$$

where S_{jT} is the share of non-oil GDP generated in sector j in year T. Formulating the final share as a residual forces the fitted values for the shares to sum to one, as well as forcing the forecast shares to sum to one.

Oil GDP is forecast separately so that only non-oil GDP was allocated to sectors using the above system. The above equation system was estimated by full information maximum likelihood, using the FIML procedure in the TSP econometrics package. This method produced reasonable share forecasts. The coefficient estimates are presented in Table II.3.[8/]

Table II.3 Estimates of the non-oil GDP share equations

	Estimated Coefficient	Standard Error	T Statistic	D.W.
Agriculture:S1				
a1	1.45594	3.90285	0.373045	2.27
b1	1.50021	6.59162	0.227594	
c1	0.0554643	0.0677187	0.819040	
Manufacturing:S2				
a2	0.116087	0.0021028	55.2041	2.26
b2	0.740302	0.129859	5.70081	
c2	-0.397212	0.0848223	-4.68288	
Electricity:S3				
a3	0.00738778	0.00107177	6.89308	1.69
b3	1.01474	0.278164	3.64801	
c3	-0.206212	0.128080	-1.61003	
Construction:S4				
a4	0.0928245	0.00916033	10.1333	1.73
b4	4.58040	0.463740	9.87708	
c4	-0.223693	0.0328150	-6.81679	
Transportation:S5				
a5	0.0542478	0.00285832	18.9789	2.74
b5	2.43425	0.941303	2.58604	
c5	-0.442732	0.139033	-3.18437	
Wholesale + Retail Trade:S6				
a6	0.197761	0.00378765	52.212	1.59
b6	0.209263	0.147611	1.41767	
c6	-0.510215	0.442427	-1.15322	

Source: Econometric Research Ltd.

Note: The coefficients a1, b1, etc. correspond to aj, bj, etc. in equation (3).

In order to produce the "Off-trend" (or O) share forecasts, the manufacturing and agriculture shares of GDP were forecast separately.[9/] The trend shares for each of the other sectors were then reduced by the same

proportion, in order that the sum of all sectoral shares equals one. The trend and off trend shares for manufacturing are reported (for 1985, 1990 and 2000) in Table II.4.

Table II.4: Forecasts of sectoral GDP shares, Indonesia
(Percentage of non-oil GDP)

A: Off-trend forecast

YEAR	SHARE1	SHARE2	SHARE3	SHARE4	SHARE5	SHARE6	SHARE7
				LOW			
1983	.343092000	.11934300	.005959950	.07700260	.053731300	.196514000	.203570300
1985	.269552000	.13232000	.007110770	.08555760	.053238430	.194183000	.258327300
1990	.213054000	.14923100	.007369220	.08757080	.052271500	.190567000	.304219300
1995	.159682000	.17653000	.006154550	.08587273	.050534800	.184226000	.336240330
2000	.118340030	.21767700	.005532540	.08196710	.048011800	.175527000	.352424030
				MEDIUM			
1983	.343092000	.11934300	.005959950	.07700260	.053731320	.196514000	.203570300
1985	.265931000	.13414800	.007393350	.08514770	.053107700	.193777000	.257694300
1990	.209439000	.15035400	.007346230	.08730600	.052108800	.189174000	.303272000
1995	.159392030	.17838700	.006852110	.08571730	.050446200	.183152300	.335510000
2000	.118222000	.21848100	.005525390	.08188490	.047963600	.174852300	.352071300
				HIGH			
1983	.343092000	.11934300	.005959950	.07700260	.053731300	.196514000	.203570000
1985	.266685000	.13484600	.007387540	.08527710	.053065100	.193511000	.257686000
1990	.208135030	.15635230	.007303320	.08677470	.051791700	.188818303	.301428330
1995	.158743000	.18142000	.006124230	.08536000	.050237000	.183143003	.334261030
2000	.117928030	.22342100	.005509710	.08166170	.047844600	.174413003	.351197030

B: Trend forecast

1983	.341571000	.11575800	.005992250	.07736030	.053980703	.197772800	.206511200
1985	.274525000	.11634200	.007241690	.08713260	.054218500	.197734000	.263053530
1990	.217992030	.11638103	.007335310	.09093440	.054244600	.197750300	.315732500
1995	.171413000	.11699700	.007368870	.09218150	.054247500	.197761333	.360342303
2000	.133711000	.11633700	.007381020	.09261340	.054247830	.197761330	.398199300

Source: Econometric Research Ltd.

Six sets of sectoral GDP forecasts were produced. Combination of the trend and off-trend shares with the high GDP level forecasts gives the high trend (H-T) and high off-trend (H-O) sectoral GDP forecasts, while combination of these forecast shares with the medium and low GDP level forecasts gives the medium and low trend (M-T and L-T) and medium and low off-trend (M-O and L-O) sectoral GDP forecasts. These forecasts are presented in the Appendixes 3 and 4.

2.5 Conversion of Demand Forecasts to Constant 1980 US Dollars

The insertion of the forecast levels of GDP and changes in sectoral GDP into the forecasting equations (1) and (2) produces forecasts of the demands for capital goods in current US dollars. However, in order to examine the size of the Indonesian market for capital goods, it is necessary to convert these forecasts into constant dollar terms. Forecasts of a price deflator for capital goods are required for this conversion.

Capital goods in Indonesia are imported mainly from developed countries such as Japan, those in Western Europe and North America. Ideally, a weighted average of capital goods price indexes from these supplying countries should be used as a basis for forecasting the price deflator for capital goods in Indonesia. However, such indexes are readily available for only a few countries. Thus data from the U.S. were used (Data from Canada produced very similar results). The period of the 1970's has demonstrated clearly the impact of oil prices on the prices of all products in the developing countries. The following equation was estimated using U.S. data for the period 1972-82.

$$(4) \qquad L_n\, PE_t = \underset{(83.3)}{3.52} + \underset{(6.94)}{0.0575\, t} + \underset{(2.33)}{0.0765\, \mathrm{Ln}\, PO_{t-1}}$$

$$R^2 = 0.988 \qquad D.W. = 1.41$$

where PE_t is the price index for equipment in period t (1980 = 100) and PO_{t-1} is the price index of oil lagged one period (1980 = 100). The coefficient of the oil price in the above equation is statistically significant (at the 5 per cent level in a one-tail test), indicating a measurable relationship between the lagged oil-price and the capital goods price. The above equation was used to generate forecasts of the price index for equipment, using the same assumptions about oil prices used in generating the "Low", "Medium" and "High" forecasts of oil revenues. Thus three forecasts of the price deflator for capital goods were generated. The annual rates of growth of capital goods prices between 1980 and 2000 which are implied by these three forecasts are 7.24, 7.34 and 7.61 per cent.

Chapter III. Indonesian Future Demand for Capital Goods. The Results of the Forecasting Exercise

3.1 The Background

Simple forecasting exercises usually involve the use of mechanical trend extrapolation for some variables of interest. Such a simple procedure may be useful in the case of some limited subset of problems where accuracy and explanation are not essential or where the growth process of the underlying phenomena is strongly stable.

These conditions are certainly inapplicable to the case of the demand for capital goods in Indonesia, both because the underlying phenomena is not stable and because explanation of behaviour is very essential given your interest in policy prescriptions.

Thus, a more refined approach is employed here. We begin by postulating a set of hypotheses about the demand for capital goods relationship and proceed to test them empirically as was described above. The assignment of specific capital goods to sectors employed engineering and other technical data, whereas the set of explanatory variables chosen, their signs and the structure of the equation were modelled along the *a priori* restrictions of economic theory.

Three target years were chosen to represent the short-run (1985), the medium-run (1990) and the long-run (2000). The actual demand values in 1980 are also presented to provide a bench-mark against which the forecasts may be checked. For each forecast alternative (trend and off-trend) we present a special table which displays the forecast values of demand for low, medium and high GDP scenarios. Although we presented the demand forecasts in both current and constant dollars, only the latter was analysed.

3.2 The Historical Trend Forecasts

History enters our system through its influence on the structure of production. The historical trend forecasts represent the projection of past logistical curves into the future. Logistic curves were used to prevent the share of any one sector from becoming too large. The historical shares and their historical trend projections are presented in the Appendixes 2 and 3. Coupling these forecasts of sectoral shares with our forecasts of GDP growth rates under alternative hypotheses of oil and LNG revenues results in the projected demands for the various capital goods presented in Table III.1 for the constant dollar forecasts and Table III.2 for the current dollar forecasts. The corresponding growth rates for constant dollar trend forecast are indicated in Appendix 8.

The analysis of the results is divided into the short-run (1985), the medium-term (1990) and the long-term (2000). We begin first with the short-run forecasts.

3.2.1 The Short-term Forecasts (1985)

Total demand for non-electrical machinery in Indonesia was $ 1,948 billion om 1980. In 1985, the lowest forecast, is for $ 3,628 billion in constant 1980 dollars, whereas the highest forecast is for $ 3,787 billion. Thus, demand for non-electrical machinery is expected to double over the five year period between 1980 and 1985.

Special industrial machinery, particularly construction and mining machinery, other special machinery, electric machinery, and transport equipment represent the major components of the forecast demand for capital goods in Indonesia in 1985.

Demand for paper and pulp machinery is slated to rise from $ 21 million in 1980 to over $ 38.8 million under the medium forcast in 1985. This represents a 13.8 per cent annual rate of growth. Demand for food processing machinery is projected to increase at about twice the rate of growth of pulp and paper machinery or at 25.7 per cent. On the other hand, construction and mining

Table III.1: TREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS

INDONESIA

(MILLIONS OF CONSTANT 1980 U.S. DOLLARS)

PRODUCTS	1980	1985			1990			1995			2000		
	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	3957.	7957.2	8221.2	8312.0	17149.8	17995.0	18208.3	37394.7	40092.6	40610.8	81829.7	89641.4	90975.1
TOTAL MACHINERY NON-ELECTRIC (71)	1948.	3627.9	3748.2	3796.8	7817.7	8212.9	8304.5	17845.3	18275.0	18520.9	37298.5	40899.4	41498.1
POWER GENERATING MACHINERY (711)	425.	639.1	660.2	657.9	1360.5	1427.5	1446.4	2954.4	3167.6	3213.4	6456.5	7073.1	7189.7
BOILER,STEAM GENERATING MACHINERY (711.1)	156.	116.0	120.7	121.2	232.3	247.1	256.6	485.5	522.7	535.5	1048.1	1147.3	1167.0
STEAM ENGINES (711.3)	3.	36.5	37.7	37.9	78.3	82.1	82.9	170.3	182.4	184.5	372.3	407.6	412.9
AIR CRAFT ENGINES (711.4)	11.	13.9	14.4	14.5	27.2	28.9	30.0	56.4	60.7	62.2	121.5	132.9	135.2
OTHER INTERNAL COMBUSTION ENGINES (711.5)	34.	58.2	60.5	60.8	119.5	126.1	131.0	249.2	268.3	274.9	539.0	590.0	600.2
NUCLEAR REACTORS (711.7)	6.	16.1	16.5	16.8	34.5	36.2	36.6	75.1	80.5	81.4	164.3	179.9	182.3
ENGINES,NES (711.9)	38.	368.2	380.4	383.8	952.3	974.2	983.6	1899.0	2035.9	2059.6	4195.0	4582.3	4644.0
AGRICULTURAL MACHINERY (712)	36.	79.0	82.3	82.3	146.4	159.5	161.2	297.1	319.7	327.4	634.0	694.0	706.7
OFFICE MACHINERY (714)	40.	59.5	61.9	62.0	114.9	122.1	126.7	236.9	255.0	261.2	509.1	557.3	566.8
TYPEWRITERS (714.1)	12.	21.3	22.1	22.2	41.2	43.7	45.4	84.9	91.4	93.6	182.6	199.8	203.3
OFFICE MACHINES,NES (714.9)	8.	7.6	7.9	7.9	13.5	14.3	14.8	27.0	29.1	29.7	57.4	62.8	63.9
METAL WORKING MACHINERY (715)	49.	102.8	106.1	106.9	222.2	233.0	235.4	484.0	519.5	525.5	1061.1	1161.7	1177.2
MACHINE TOOLS (715.1)	36.	85.1	87.9	88.5	186.0	195.0	197.0	407.2	436.3	441.3	892.1	975.7	989.7
TEXTILE MACHINERY (717.1)	170.	447.4	461.3	455.7	981.7	1029.6	1040.2	2152.2	2306.4	2333.0	4717.4	5165.3	5234.2

Table III.1: TREND FORECAST OF THE DEMAND FOR CAPITAL GOODS
(continued)
INDONESIA
(MILLIONS OF CONSTANT 1990 U.S. DOLLARS)

	1980	1985			1990			1995			2000		
PRODUCTS	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
SKIN,LEATHER WORKING MACHINERY (717.2)	3.	6.2	6.4	6.4	12.8	13.6	14.1	27.0	29.1	29.8	58.6	64.1	65.2
SEWING MACHINERY (717.3)	31.	43.5	45.2	45.3	85.1	90.5	93.9	176.4	189.8	194.5	379.7	415.6	422.7
SPECIAL INDUSTRIAL MACHINERY (718)	325.	667.6	689.5	695.1	1435.4	1516.0	1523.2	3127.3	3352.8	3394.7	6841.5	7494.4	7602.8
PAPER AND PULP MACHINERY (718.1)	21.	37.3	38.9	39.0	76.5	81.4	84.6	161.2	173.6	177.9	349.1	382.1	388.7
PRINTING MACHINERY (718.2)	27.	49.0	50.5	50.9	104.6	109.7	110.8	227.4	243.7	246.4	497.0	544.2	551.4
FOOD PROCESSING MACHINERY (718.3)	19.	57.6	59.5	59.9	121.1	127.1	128.1	261.9	280.7	283.3	571.5	625.9	632.9
CONSTRUCTION,MINING MACHINERY (718.4)	220.	331.5	344.5	345.7	644.6	695.3	711.2	1332.9	1434.8	1469.7	2867.0	3138.2	3192.8
MINERAL AND GLASS WORKING MACHINERY (718.5)	38.	73.5	75.3	76.3	151.8	159.2	160.5	326.1	349.4	353.8	710.0	777.4	786.9
OTHER SPECIAL MACHINERY (719)	968.	1692.8	1749.2	1757.8	3681.9	3853.6	3912.5	8052.2	8633.4	8751.4	17637.2	19321.4	19623.1
HEATING,COOLING EQUIPMENT (719.1)	171.	294.3	304.1	307.6	638.4	659.9	678.9	1394.9	1495.6	1517.2	3054.4	3346.1	3401.1
PUMPS AND CENTRIFUGES (719.2)	124.	299.1	309.1	311.8	648.3	680.2	687.6	1416.1	1518.2	1536.3	3100.5	3396.4	3443.4
MECHANICAL HANDLING EQUIP (719.3)	124.	293.5	303.4	306.4	642.7	674.4	682.4	1408.4	1510.1	1529.6	3097.0	3381.7	3431.9
POWERED-TOOLS,OTHER (719.5)	53.	37.7	38.9	39.0	71.4	74.7	75.3	148.3	158.8	160.4	319.3	349.4	353.7
SPRAYING,VENDING, OTHER MACHINERY (719.6)	29.	76.6	79.1	79.6	166.4	174.6	175.9	363.4	389.6	393.1	795.7	871.6	881.8
BALL,ROLLER BEARINGS (719.7)	19.	19.6	20.4	20.5	37.6	40.0	41.5	77.4	83.3	85.3	166.1	181.8	184.9
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	143.	280.2	289.4	292.4	597.1	626.5	634.4	1297.2	1390.8	1409.9	2835.2	3106.0	3155.0
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	201.	308.3	318.7	322.8	679.9	713.5	724.2	1493.6	1601.5	1626.9	3276.1	3589.1	3653.2

Table III.1: TREND FORECAST OF THE DEMAND FOR CAPITAL GOODS
(continued)
INDONESIA
(MILLIONS OF CONSTANT 1980 U.S. DOLLARS)

PRODUCTS	1980	1985			1990			1995			2000		
	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
TOTAL ELECTRICAL MACHINERY (72)	82.	1309.6	1360.7	1365.2	2514.9	2673.2	2773.1	5175.5	5570.6	5705.8	11113.5	12164.4	12372.9
ELECTRICAL POWER MACHINERY (722)	297.	469.3	487.9	499.6	918.1	976.2	1013.2	1902.7	2048.1	2098.1	4095.5	4482.9	4559.9
POWER TRANSFORMING MACHINERY (722.1)	224.	366.1	380.5	391.8	709.5	754.3	782.7	1465.1	1577.1	1615.4	3149.9	3447.8	3506.9
SWITCH GEAR, ETC. (722.2)	73.	121.2	126.0	126.5	238.9	254.0	263.7	496.4	534.4	547.4	1369.5	1178.7	1198.8
EQUIPMENT FOR DISTRIBUTIN ELECTRICITY (723)	158.	229.3	238.3	239.1	444.4	472.4	490.2	917.7	987.8	1011.8	1973.0	2159.6	2196.6
INSULATED WIRE AND CABLE (723.1)	135.	201.9	209.9	218.6	389.7	414.3	429.8	803.5	864.9	885.9	1726.6	1889.8	1922.2
ELECTRIC INSULATED EQUIPMENT (723.2)	24.	41.0	42.7	42.9	84.5	90.0	93.5	178.5	192.2	197.0	386.7	423.3	430.6
ELECTRICAL MACHINERY OTHER (729)	141.	289.6	300.9	311.9	557.5	592.6	614.8	1148.3	1236.0	1266.8	2466.7	2699.9	2746.2
BATTERIES AND ACCUMULATORS (729.1)	81.	113.1	117.5	117.9	214.7	228.2	236.7	440.0	473.5	485.0	943.3	1032.4	1050.1
ELECTRIC LAMPS (729.2)	18.	30.9	32.2	32.3	61.6	65.5	68.0	128.4	138.3	141.6	277.1	303.3	308.5
VALVES, TUBES, ETC. (729.3)	15.	35.7	37.2	37.3	73.7	78.4	81.5	155.6	167.5	171.6	337.0	368.9	375.3
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	25.	38.3	39.5	40.0	82.5	86.6	87.6	179.9	192.9	195.3	393.7	431.4	437.6
MEASURING APPARATUS (729.5)	29.	164.6	170.1	171.6	382.0	410.7	404.9	851.9	913.0	923.5	1877.4	2055.5	2082.8
ELECTRO-MECHANICAL HAND TOOLS (729.6)	6.	13.7	14.2	14.3	30.9	32.3	32.7	68.1	73.0	73.8	149.6	163.8	166.8
OTHER, NES (729.9)	57.	172.6	178.3	179.5	380.1	398.9	402.4	834.2	894.4	903.8	1829.8	2003.7	2026.9
TOTAL TRANSPORT EQUIPMENT (73)	1227.	2800.5	2894.7	2921.3	6115.4	6417.7	6488.1	13391.8	14359.1	14529.6	29345.1	32148.7	32592.6
RAILWAY VEHICLES (731)	296.	112.4	116.1	117.1	246.8	258.9	261.7	541.3	580.3	587.2	1186.8	1299.9	1317.7

Table III.1: TREND FORECAST OF THE DEMAND FOR CAPITAL GOODS
(continued)
INDONESIA
(MILLIONS OF CONSTANT 1980 U.S. DOLLARS)

	1980	1985			1990			1995			2000		
PRODUCTS	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
LOCOMOTIVES, OTHER (731.3)	6.	38.2	39.5	39.9	84.7	88.9	89.9	186.4	199.9	202.4	409.2	440.3	454.7
PASSENGERS' RAILWAY, TRAMWAY CARS (731.5)	12.	59.1	60.3	61.2	128.9	135.1	136.2	281.9	301.0	304.9	617.3	675.2	683.5
RAILWAY, LOCOMOTIVE CAR PARTS, NES (731.7)	2.	4.9	5.1	5.1	8.6	9.0	9.1	17.4	18.6	18.8	37.1	40.6	41.2
BUSSES (732.2)	31.	28.9	29.7	29.9	47.5	49.7	50.2	93.1	99.7	100.8	196.2	214.9	217.9
LORRIES AND TRUCKS (732.3)	186.	1099.4	1136.7	1148.0	2441.2	2562.2	2591.9	5374.6	5763.2	5834.5	11797.5	12925.1	13109.4
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	33.	47.6	49.4	49.6	91.8	97.6	101.3	189.4	203.9	208.8	407.8	445.4	453.1
TRACTORS FOR TR-TRAILERS (732.5)	12.	8.1	8.4	8.5	6.8	7.1	7.3	7.3	8.0	8.2	10.7	12.1	12.7
SHIPS AND BOATS (735)	35.	259.1	267.9	269.6	565.2	593.1	598.2	1237.3	1326.5	1339.1	2710.8	2969.5	3003.3
SHIPS AND BOATS NON-WAR (735.3)	16.	49.9	51.5	52.0	109.5	114.9	116.1	240.2	257.4	260.5	526.5	576.6	584.5
SHIPS AND BOATS NES (735.9)	17.	72.2	74.6	75.4	147.6	155.0	156.8	316.4	339.4	343.7	688.5	754.8	766.1

SOURCE: ECONOMETRIC RESEARCH LTD.

Note: The growth rates corresponding to the trend forecast in this table (based on constant 1980 US dollars) are contained in Appendix 8.

Table III.2: TREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS

INDONESIA

(MILLIONS OF CURRENT U.S. DOLLARS)

PRODUCTS	1980	1985			1990			1995			2000		
	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	3957.	11926.	12087.	12241.	36823.	37148.	37994.	113780.	115877.	119174.	354750.	362735.	374881.
TOTAL MACHINERY NON-ELECTRIC (71)	1940.	5437.	5511.	5583.	16695.	16934.	17329.	51863.	52819.	54351.	161700.	165330.	170960.
POWER GENERATING MACHINERY (711)	425.	950.	971.	984.	2905.	2947.	3018.	8989.	9155.	9430.	27991.	28621.	29627.
BOILER,STEAM GENERATING MACHINERY (711.1)	156.	174.	178.	179.	496.	510.	536.	1477.	1511.	1572.	4544.	4643.	4809.
STEAM ENGINES (711.3)	3.	55.	55.	56.	167.	169.	173.	518.	527.	541.	1614.	1649.	1702.
AIR CRAFT ENGINES (711.4)	11.	21.	21.	21.	58.	60.	63.	172.	176.	183.	527.	538.	557.
OTHER INTERNAL COMBUSTION ENGINES (711.5)	34.	87.	89.	90.	253.	260.	273.	756.	775.	807.	2337.	2397.	2473.
NUCLEAR REACTORS (711.7)	6.	24.	24.	25.	74.	75.	76.	229.	233.	239.	712.	728.	751.
ENGINES,NES (711.8)	38.	552.	559.	566.	1820.	1846.	1886.	5780.	5884.	6044.	19147.	18545.	19137.
AGRICULTURAL MACHINERY (712)	36.	118.	121.	121.	313.	321.	336.	904.	924.	961.	2792.	2812.	2912.
OFFICE MACHINERY (714)	40.	89.	91.	91.	245.	252.	264.	721.	737.	767.	2207.	2255.	2336.
TYPEWRITERS (714.1)	12.	32.	33.	33.	88.	90.	95.	250.	264.	275.	792.	803.	830.
OFFICE MACHINES,NES (714.3)	8.	11.	12.	12.	29.	30.	31.	82.	84.	87.	249.	254.	263.
METAL WORKING MACHINERY (715)	49.	154.	156.	158.	475.	481.	491.	1479.	1502.	1542.	4688.	4781.	4851.
MACHINE TOOLS (715.1)	36.	128.	129.	131.	397.	403.	411.	1239.	1261.	1295.	3868.	3952.	4078.
TEXTILE MACHINERY (717.1)	170.	671.	679.	587.	2096.	2126.	2171.	5549.	6666.	5846.	20452.	20981.	21569.

Table III.2: TREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS
(continued)
INDONESIA
(MILLIONS OF CURRENT U.S. DOLLARS)

	1980	1985			1990			1995			2000		
PRODUCTS	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
SKIN,LEATHER WORKING MACHINERY (717.2)	3.	9.	9.	10.	27.	25.	30.	82.	84.	88.	254.	260.	269.
SEWING MACHINERY (717.3)	31.	65.	66.	57.	182.	187.	196.	537.	549.	571.	1645.	1682.	1742.
SPECIAL INDUSTRIAL MACHINERY (718)	325.	1001.	1014.	1026.	3065.	3109.	3179.	9515.	9690.	9962.	29660.	30326.	31329.
PAPER AND PULP MACHINERY (718.1)	21.	56.	57.	57.	163.	168.	177.	491.	502.	522.	1513.	1546.	1602.
PRINTING MACHINERY (718.2)	27.	73.	74.	75.	223.	227.	231.	692.	704.	723.	2155.	2202.	2272.
FOOD PROCESSING MACHINERY (718.3)	19.	86.	88.	88.	259.	262.	267.	797.	811.	831.	2477.	2533.	2608.
CONSTRUCTION,MINING MACHINERY (718.4)	220.	497.	507.	510.	1377.	1415.	1484.	4056.	4147.	4313.	12429.	12639.	13154.
MINERAL AND GLASS WORKING MACHINERY (718.5)	38.	110.	112.	113.	324.	329.	335.	992.	1010.	1036.	3075.	3146.	3243.
OTHER SPECIAL MACHINERY (718)	960.	2537.	2572.	2587.	7063.	7376.	8164.	24500.	24953.	25682.	76462.	78184.	80861.
HEATING,COOLING EQUIPMENT (719.1)	171.	441.	447.	454.	1363.	1383.	1417.	4244.	4323.	4452.	13242.	13540.	14015.
PUMPS AND CENTRIFUGES (719.2)	124.	448.	454.	460.	1384.	1404.	1435.	4309.	4388.	4508.	13441.	13744.	14189.
MECHANICAL HANDLING EQUIP (719.3)	124.	440.	446.	452.	1372.	1392.	1424.	4295.	4364.	4489.	13383.	13684.	14142.
POWERED-TOOLS,OTHER (719.5)	53.	57.	57.	58.	152.	154.	157.	451.	459.	471.	1384.	1414.	1458.
SPRAYING,VENDING, OTHER MACHINERY (719.6)	29.	115.	116.	117.	355.	360.	367.	1106.	1126.	1154.	3449.	3527.	3638.
BALL,ROLLER BEARINGS (719.7)	19.	29.	30.	30.	80.	83.	87.	235.	241.	250.	728.	736.	762.
MACHINERY AND MECHANICAL APPLIANCES,NES (719.9)	143.	420.	426.	431.	1275.	1293.	1324.	3947.	4020.	4138.	12292.	12569.	13001.
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	201.	462.	469.	476.	1452.	1473.	1511.	4544.	4629.	4774.	14283.	14523.	15894.

Table III.2: (continued)

TREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS
INDONESIA
(MILLIONS OF CURRENT U.S. DOLLARS)

PRODUCTS	1980 ACTUAL VALUES	1985 LOW	MED	HIGH	1990 LOW	MED	HIGH	1995 LOW	MED	HIGH	2000 LOW	MED	HIGH
TOTAL ELECTRICAL MACHINERY (72)	782.	1963.	2001.	2313.	5370.	5518.	5787.	15747.	16101.	16744.	48183.	49224.	50985.
ELECTRICAL POWER MACHINERY (722)	297.	703.	717.	722.	1961.	2115.	2114.	5789.	5920.	6157.	17755.	18148.	18790.
POWER TRANSFORMING MACHINERY (722.1)	224.	549.	960.	563.	1519.	1357.	1633.	4458.	4558.	4741.	13656.	13951.	14451.
SWITCH GEAR, ETC. (722.2)	73.	182.	189.	187.	510.	524.	550.	1510.	1544.	1607.	4637.	4737.	4907.
EQUIPMENT FOR DISTRIBUTIN ELECTRICITY (723)	158.	344.	390.	353.	949.	975.	1023.	2792.	2855.	2969.	8553.	8739.	9052.
INSULATED WIRE AND CABLE (723.1)	135.	303.	309.	310.	832.	855.	897.	2445.	2500.	2600.	7485.	7647.	7921.
ELECTRIC INSULATED EQUIPMENT (723.2)	24.	62.	63.	53.	181.	186.	195.	543.	556.	578.	1677.	1713.	1775.
ELECTRICAL MACHINERY OTHER (729)	141.	434.	442.	449.	1190.	1223.	1283.	3494.	3572.	3715.	10594.	10925.	11316.
BATTERIES AND ACCUMULATORS (729.1)	81.	170.	173.	174.	459.	471.	494.	1339.	1369.	1423.	4089.	4179.	4327.
ELECTRIC LAMPS (729.2)	18.	46.	47.	48.	132.	135.	142.	391.	400.	416.	1201.	1227.	1271.
VALVES,TUBES, ETC. (729.3)	15.	54.	55.	55.	157.	162.	170.	473.	484.	504.	1461.	1493.	1547.
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	25.	57.	58.	59.	176.	179.	183.	547.	558.	573.	1707.	1746.	1803.
MEASURING APPARATUS (729.5)	29.	247.	250.	253.	816.	927.	945.	2592.	2639.	2718.	8139.	8315.	8583.
ELECTRO-MECHANICAL HAND TOOLS (729.6)	6.	21.	21.	21.	66.	67.	68.	207.	211.	217.	649.	663.	684.
OTHERS,NES (729.9)	57.	259.	262.	265.	812.	823.	840.	2538.	2585.	2650.	7929.	8138.	8352.
TOTAL TRANSPORT EQUIPMENT (73)	1227.	4190.	4296.	4307.	13059.	13246.	13938.	40747.	41581.	42639.	127219.	130898.	134384.
RAILWAY VEHICLES (731)	296.	168.	171.	173.	527.	535.	546.	1647.	1677.	1723.	5145.	5260.	5438.

Table III.2: TREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS
(continued)
INDONESIA
(MILLIONS OF CURRENT U.S. DOLLARS)

PRODUCTS	1980	1985			1990			1995			2000		
	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
LOCOMOTIVES, OTHER (731.3)	6.	57.	58.	59.	181.	184.	188.	567.	578.	594.	1774.	1814.	1874.
PASSENGERS, RAILWAY, TRAMWAY CARS (731.5)	12.	89.	90.	90.	275.	279.	284.	858.	872.	895.	2676.	2732.	2816.
RAILWAY, LOCOMOTIVE CAR PARTS, NES (731.7)	2.	7.	7.	8.	18.	19.	19.	53.	54.	55.	161.	164.	170.
BUSES (732.2)	31.	43.	44.	44.	101.	103.	105.	283.	288.	296.	851.	870.	890.
LORRIES AND TRUCKS (732.3)	186.	1648.	1671.	1693.	5213.	5299.	5408.	16353.	16657.	17122.	51145.	52382.	54820.
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	33.	71.	73.	73.	196.	202.	211.	576.	589.	613.	1764.	1803.	1867.
TRACTORS FOR TRAILERS (732.5)	12.	12.	12.	13.	15.	15.	15.	22.	23.	24.	47.	49.	53.
SHIPS AND BOATS (735)	35.	388.	394.	398.	1207.	1224.	1248.	3765.	3834.	3930.	11792.	12016.	12376.
SHIPS AND BOATS NON-WAR (735.3)	16.	75.	76.	77.	234.	237.	242.	731.	744.	764.	2283.	2333.	2409.
SHIPS AND BOATS NES (735.9)	17.	108.	110.	111.	315.	320.	327.	963.	981.	1009.	2985.	3055.	3157.

SOURCE: ECONOMETRIC RESEARCH LTD.

machinery demand is expected to grow at the relatively low rate of growth of 9.4 per cent during the same period.

In short, despite low rates of growth of the economy at large the demand for machinery, even under the lowest growth scenario, is expected to grow at high rates and the dollar volume is, by any standards, substantial.

3.2.2 The Medium-Term Forecasts (1990)

The medium-term forecast is more optimistic for the economy and for the capital goods sector than that of the short-term. Both oil prices and GDP are expected to display vigorous growth and this is automatically reflected in the demand for capital goods forecast.

The total demand for non-electrical machinery in Indonesia is forecast to reach $ 8.2 billion under the medium forecast conditions in 1990. This represents over a four-fold increase over the 1980 actual demand. Not surprisingly the rate of growth of this demand betwen 1980 and 1990 is projected to exceed 15.5 per cent -- or about two percentage points above the expected rate for the 1980-1985 period.

The special emphasis group (plant processing equipment) shows comparable dynamism. Food processing machinery shows the highest rate of growth of about 21 per cent per year. This is a bit lower than that expected for the period 1980-1985, but still a very rapid rate indeed. Demand for pulp and paper machinery is expected to reach $ 81.4 million which translates into an annual rate of increase of over 14.5 per cent between 1980-1990. This rate is higher than that projected for this sector between 1980-1985.

3.2.3 The Long-Term Forecasts (2000)

The long-term forecast of the demand for capital goods is optimistic. The growth trend expected in the medium-trend is expected to accelerate further in the long-term particularly as the oil market tightens and LNG revenues reach peak levels.

The long-term demand for non-electrical machinery is expected to top $ 37.3 billion under the most pessimistic forecast and to approach $ 41.5

billion under the most optimistic conditions. In either case, the projected demand for the year 2000 is about 20 times the actual 1980 volume in constant 1980 US dollars. Such a volume is large enough to support a broad production programme of all types of non-electrical machines in Indonesia. Almost half the expected demand for engineering products in Indonesia will be accounted for by non-electrical machinery in the year 2000. This is despite the fact that under the historical trend assumptions demand for capital goods is slated to grow at slower rates than those projected for engineering products.

Special industrial machinery demand is projected to reach about $ 7.5 billion (under the medium forecast). Demand for pulp and paper machinery will account for $ 382 million, whereas the demand for food processing machinery will account for $ 626 million. The largest component of this product group is the demand for construction and mining equipment which is projected to account for about one-half of the total demand for this category ($3.2 billion).

3.3 The Off-Trend Forecasts

The historical trend is not expected to hold as Indonesian planners will certainly intercede to alter the course of the economy and re-structure it to meet their target vectors of output. Repelita IV is already on the drawing boards and the current low ratio of manufacturing value added to GDP and the limited production of non-electrical machinery are the focus of the planners interest and consideration.

If planning has any meaning it is its vision and ability to change the historical course of the economy. This is why our forecasts are adjusted to reflect planners preferences and as such our forecasts become consequences of what might be expected if planners are to realise their targets.

Two primary changes were introduced to alter the historical trend forecasts. First the share of manufacturing is raised to 17.5 per cent of the total GDP and thus all other shares were scaled accordingly. Second, a different rate of growth for GDP was envisioned to correspond to the expected new structure of the economy. The results of such changes are drastic indeed, as is evident in Tables III.3 and III.4. The corresponding growth rates for constant dollar off-trend forecast are indicated in Appendix 9.

3.3.1 The Short-term Forecasts (1985)

The forecast demands for capital goods are highly sensitive to the underlying assumptions about sectoral shares in the structure of GDP. Although the forecasts are sensitive to GDP, they are more markedly sensitive to the assumptions about sectoral shares. The magnitude of sensitivity grows over time, but it is still visible in the short-term.

The demand for non-electrical machinery is projected to reach $ 4.7 billion under the high GDP scenario, and about $ 4.3 billion under the low GDP scenario in 1985. Regardless of the GDP forecast, the off-trend demand forecasts are substantially higher than the corresponding values under the historical trend assumptions.

Demand for special industrial machinery reveals the same profile, showing a forecast value of $ 841 million under the medium GDP scenario in 1985. Demand for food processing machinery is expected to exceed $ 70 million and demand for pulp and paper machinery $ 39.8 million. Whereas the demand for food processing machinery is slated to rise under the off-trend scenario, that for pulp and paper appears invariant to this change.

3.3.2 The Medium-Term Forecasts (1990)

The medium-term forecasts reveal more clearly and distinctly the influence of growing off-the-trend. Demand for non-electrical machinery is projected to reach $ 11.7 billion (or about $ 3.5 billion above the historical trend projection) by 1990. Similar substantial increases are also noted in the various sub-components of non-electrical machinery. Demand for special industrial machinery will likely exceed $ 2.1 billion; and demand for other special industrial machinery could exceed $ 5.4 billion. This argues for a major increase in the demand for plant processing equipment.

Some sub-components of machinery demand will not increase however, as much as the general increase in the group demand. This is particularly evident in the demand for pulp and paper machinery and mining equipment. On the other hand, substantial increases are noted in the demand for food processing machinery, mineral and glass working machinery, and pumps and centrifuges.

Table III.3: DETREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS
INDONESIA
(MILLIONS OF CONSTANT 1980 U.S. DOLLARS)

PRODUCTS	1980	1985			1990			1995			2000		
	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	3957.	9183.4	9793.0	10222.4	23875.2	25214.9	25941.4	64922.9	69756.8	71105.6	177690.8	194750.2	198055.4
TOTAL MACHINERY NON-ELECTRIC (71)	1948.	4254.0	4532.3	4741.8	11374.1	11635.8	12049.4	30124.6	32367.4	33039.5	82456.9	90372.2	92033.4
POWER GENERATING MACHINERY (711)	425.	758.0	807.1	843.8	1354.0	2053.6	2125.5	5301.4	5696.0	5913.7	14500.8	15892.7	16183.9
BOILER,STEAM GENERATING MACHINERY (711.1)	156.	116.0	120.7	121.2	232.3	247.1	256.6	485.5	522.7	535.5	1048.1	1147.3	1167.0
STEAM ENGINES (711.3)	3.	44.1	47.0	49.1	113.5	119.9	123.5	308.1	330.9	337.3	842.5	922.9	937.6
AIR CRAFT ENGINES (711.4)	11.	13.9	14.4	14.5	27.2	28.9	30.0	56.4	60.7	62.2	121.5	132.9	135.2
OTHER INTERNAL COMBUSTION ENGINES (711.5)	34.	58.2	60.6	60.8	118.5	126.1	131.0	249.2	268.3	274.9	539.0	590.8	600.2
NUCLEAR REACTORS (711.7)	6.	15.7	16.1	16.1	32.4	34.0	34.2	67.0	71.7	72.4	136.6	149.5	151.4
ENGINES,NES (711.8)	38.	454.3	487.3	510.7	1253.9	1325.6	1365.7	3464.9	3722.5	3795.0	9520.0	10423.3	10596.6
AGRICULTURAL MACHINERY (712)	36.	79.0	82.0	82.3	146.4	155.5	161.2	297.1	319.7	327.4	634.8	694.8	706.7
OFFICE MACHINERY (714)	40.	59.5	61.5	62.0	114.9	122.1	126.7	236.9	255.0	261.2	509.1	557.3	566.8
TYPEWRITERS (714.1)	12.	21.3	22.1	22.2	41.2	43.7	45.4	84.9	91.4	93.6	182.6	199.8	203.3
OFFICE MACHINES,NES (714.9)	8.	7.6	7.5	7.9	13.5	14.3	14.8	27.0	29.1	29.7	57.4	62.8	63.9
METAL WORKING MACHINERY (715)	49.	125.1	133.5	139.4	324.9	343.3	353.4	883.7	949.4	967.6	2418.5	2643.5	2692.0
MACHINE TOOLS (715.1)	36.	103.7	110.7	115.7	271.8	287.2	295.7	741.1	796.2	811.5	2029.5	2223.3	2258.9
TEXTILE MACHINERY (717.1)	170.	547.3	584.4	610.9	1440.8	1522.4	1567.4	3933.1	4225.3	4306.6	10773.4	11803.0	11992.4

Table III.3: (continued)

DETREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS
INDONESIA
(MILLIONS OF CONSTANT 1980 U.S. DOLLARS)

	1980	1985			1990			1995			2000		
PRODUCTS	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
SKIN,LEATHER WORKING MACHINERY (717.2)	3.	6.2	6.4	6.4	12.8	13.6	14.1	27.0	29.1	29.8	58.6	64.1	65.2
SEWING MACHINERY (717.3)	31.	43.5	45.2	45.3	85.1	90.5	93.9	176.4	189.0	194.5	379.7	415.6	422.7
SPECIAL INDUSTRIAL MACHINERY (718)	325.	789.6	841.2	876.6	2052.2	2157.5	2223.9	5580.4	5995.8	6094.6	15273.0	16730.5	16973.4
PAPER AND PULP MACHINERY (718.1)	21.	37.3	38.3	39.0	76.5	81.4	84.6	161.2	173.6	177.9	349.1	382.1	388.7
PRINTING MACHINERY (718.2)	27.	59.5	63.5	66.3	153.1	151.7	166.5	415.2	446.1	454.6	1135.5	1244.0	1264.0
FOOD PROCESSING MACHINERY (718.3)	19.	66.3	70.5	72.7	168.2	177.7	180.1	454.4	488.2	490.2	1241.4	1360.4	1362.4
CONSTRUCTION,MINING MACHINERY (718.4)	220.	331.5	344.5	345.7	644.6	695.3	711.2	1332.9	1434.8	1469.7	2867.0	3130.2	3192.0
MINERAL AND GLASS WORKING MACHINERY (718.5)	38.	109.2	116.4	122.1	280.2	296.0	306.8	759.6	816.0	837.0	2076.9	2275.3	2329.5
OTHER SPECIAL MACHINERY (7[illegible])	368.	1969.0	2090.7	2212.0	5166.4	5456.6	5636.2	14084.0	15132.9	15486.7	39572.2	42275.7	43163.0
HEATING,COOLING EQUIPMENT (719.1)	171.	341.1	363.5	382.0	892.6	942.7	975.5	2431.5	2612.6	2678.0	6658.1	7297.4	7465.4
PUMPS AND CENTRIFUGES (719.2)	124.	343.7	366.2	381.8	897.5	947.9	972.5	2443.6	2625.6	2660.3	6590.1	7332.3	7434.0
MECHANICAL HANDLING EQUIP (719.3)	124.	339.1	361.5	379.4	894.4	944.7	975.7	2441.6	2623.5	2684.4	6589.4	7331.7	7484.1
POWERED-TOOLS,OTHER (719.5)	53.	37.0	37.3	37.9	67.7	70.8	71.1	133.7	143.0	144.2	258.9	294.1	297.5
SPRAYING,VENDING, OTHER MACHINERY (719.6)	29.	74.6	76.6	76.8	156.2	153.7	164.7	323.4	346.5	349.6	650.5	721.2	729.9
BALL,ROLLER BEARINGS (719.7)	19.	19.6	20.4	20.5	37.6	40.0	41.5	77.4	83.3	85.3	166.1	181.0	184.9
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	143.	313.1	333.2	350.9	803.5	848.4	880.5	2176.0	2338.9	2405.8	5952.2	6524.1	6696.7
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	201.	371.3	396.1	418.3	989.3	1045.0	1086.1	2708.1	2909.9	2996.0	7424.7	8137.6	8359.1

Table III.3: OFFTREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS
(continued)

INDONESIA

(MILLIONS OF CONSTANT 1980 U.S. DOLLARS)

PRODUCTS	1980 ACTUAL VALUES	1985 LOW	1985 MED	1985 HIGH	1990 LOW	1990 MED	1990 HIGH	1995 LOW	1995 MED	1995 HIGH	2000 LOW	2000 MED	2000 HIGH
TOTAL ELECTRICAL MACHINERY (72)	782.	1309.6	1360.7	1365.2	2514.9	2673.2	2773.1	5175.5	5570.6	5705.8	11113.5	12164.4	12372.9
ELECTRICAL POWER MACHINERY (722)	297.	469.3	487.9	493.6	918.1	976.2	1013.2	1902.7	2048.1	2098.1	4095.5	4482.9	4559.9
POWER TRANSFORMING MACHINERY (722.1)	224.	366.1	380.5	381.8	709.5	754.3	782.7	1465.1	1577.1	1615.4	3149.9	3447.8	3506.9
SWITCH GEAR, ETC. (722.2)	73.	121.2	126.0	126.5	238.9	254.0	263.7	496.4	534.4	547.4	1069.5	1170.7	1190.8
EQUIPMENT FOR DISTRIBUTIN ELECTRICITY (723)	158.	229.3	238.3	239.1	444.4	472.4	490.7	917.7	987.8	1011.8	1973.0	2159.6	2196.6
INSULATED WIRE AND CABLE (723.1)	135.	201.9	209.9	210.6	389.7	414.3	429.8	803.5	864.9	885.9	1726.6	1889.8	1922.2
ELECTRIC INSULATED EQUIPMENT (723.2)	24.	41.0	42.7	42.9	84.5	90.0	93.5	178.5	192.2	197.0	396.7	423.3	430.6
ELECTRICAL MACHINERY OTHER (729)	141.	289.6	300.9	301.9	557.5	592.6	614.8	1148.3	1236.0	1266.0	2466.7	2699.9	2746.2
BATTERIES AND ACCUMULATORS (729.1)	81.	113.1	117.5	117.9	214.7	228.2	236.7	440.0	473.5	485.0	943.3	1032.4	1050.1
ELECTRIC LAMPS (729.2)	18.	30.9	32.2	32.3	61.6	65.5	68.0	128.4	138.3	141.6	277.1	303.3	308.5
VALVES,TUBES, ETC. (729.3)	15.	35.7	37.2	37.3	73.7	78.4	81.5	155.6	167.5	171.6	337.0	368.9	375.3
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	25.	37.0	38.0	39.2	76.7	80.4	81.1	158.3	169.7	171.5	321.5	352.3	357.0
MEASURING APPARATUS (729.5)	29.	203.2	217.3	229.2	561.3	593.3	611.4	1551.6	1667.0	1599.5	4263.6	4670.8	4745.6
ELECTRO-MECHANICAL HAND TOOLS (729.6)	6.	16.9	18.1	18.9	45.4	48.0	49.4	124.7	133.9	136.5	342.0	374.7	380.7
OTHER,NES (729.9)	57.	168.5	173.1	173.5	358.0	375.2	377.7	744.5	797.8	805.3	1518.2	1662.9	1683.5
TOTAL TRANSPORT EQUIPMENT (73)	1227.	2729.4	2805.7	2814.4	5749.2	6034.9	6070.6	11929.0	12782.9	12914.8	24307.3	26624.8	26977.6
RAILWAY VEHICLES (731)	296.	108.8	111.5	112.1	230.8	241.8	243.5	480.1	514.4	519.5	990.2	1073.4	1087.1

Table III.3: OFFTREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS
(continued)
INDONESIA
(MILLIONS OF CONSTANT 1980 U.S. DOLLARS)

	1980	1985			1990			1995			2000		
PRODUCTS	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
LOCOMOTIVES, OTHER (731.3)	6.	36.3	37.3	38.0	78.9	82.7	83.3	164.4	176.2	178.1	335.4	367.5	372.4
PASSENGERS' RAILWAY, TRAMWAY CARS (731.5)	12.	57.8	59.2	59.2	122.3	128.0	128.5	255.0	272.8	274.9	523.4	572.4	578.8
RAILWAY, LOCOMOTIVE CAR PARTS, NES (731.7)	2.	4.8	4.9	4.9	8.1	8.5	8.5	15.4	16.5	16.6	30.4	33.3	33.7
BUSES (732.2)	31.	28.2	29.0	29.0	44.7	46.7	47.0	82.5	88.4	89.2	161.1	176.4	178.6
LORRIES AND TRUCKS (732.3)	186.	1070.3	1101.1	1134.9	2294.0	2414.4	2423.5	4785.9	5128.9	5183.3	9769.0	10700.9	10845.3
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	33.	47.5	49.4	49.6	91.8	97.6	101.3	189.4	203.9	208.8	407.0	445.4	453.1
TRACTORS FOR TR-TRAILERS (732.5)	12.	7.8	8.1	8.1	5.8	6.1	6.2	4.3	4.7	5.0	2.2	2.7	3.2
SHIPS AND BOATS (735)	35.	252.3	259.2	259.7	531.0	556.4	559.9	1101.9	1180.6	1191.4	2246.4	2460.2	2490.0
SHIPS AND BOATS NON-WAR (735.3)	16.	48.3	49.5	49.7	102.4	107.3	108.1	213.2	228.4	230.6	435.3	475.6	482.7
SHIPS AND BOATS NES (735.9)	17.	69.6	71.5	71.9	136.7	143.3	144.6	276.3	296.3	299.6	556.0	609.5	618.2

SOURCE: ECONOMETRIC RESEARCH LTD.

Note: The growth rates corresponding to the off-trend forecast in this table (based on constant 1980 US dollars) are contained in Appendix 9.

Table III.4: OFFTREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS

INDONESIA

(MILLIONS OF CURRENT U.S. DOLLARS)

PRODUCTS	1980 ACTUAL VALUES	1985 LOW			1990 LOW			1995 LOW			2000 LOW		
		LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	3957.	13764.	14383.	15172.	53985.	52153.	54130.	137539.	201614.	208667.	770340.	788059.	816127.
TOTAL MACHINERY NON-ELECTRIC (71)	1948.	6376.	6664.	6992.	23648.	24144.	25143.	91659.	93550.	96958.	357474.	365692.	379242.
POWER GENERATING MACHINERY (711)	425.	1136.	1187.	1244.	4173.	4260.	4435.	15130.	16463.	17061.	62865.	64310.	66689.
BOILER, STEAM GENERATING MACHINERY (711.1)	156.	174.	178.	179.	496.	510.	536.	1477.	1511.	1572.	4544.	4643.	4809.
STEAM ENGINES (711.3)	3.	66.	69.	72.	242.	248.	258.	937.	956.	990.	3652.	3734.	3864.
AIR CRAFT ENGINES (711.4)	.1.	21.	21.	21.	58.	60.	63.	172.	176.	183.	527.	538.	557.
OTHER INTERNAL COMBUSTION ENGINES (711.5)	34.	87.	89.	90.	253.	260.	273.	758.	775.	807.	2337.	2387.	2473.
NUCLEAR REACTORS (711.7)	6.	24.	24.	24.	69.	70.	71.	204.	207.	213.	592.	605.	624.
ENGINES, NES (711.8)	38.	682.	716.	753.	2678.	2736.	2950.	10543.	10759.	11137.	41272.	42202.	43665.
AGRICULTURAL MACHINERY (712)	36.	118.	121.	121.	313.	321.	336.	904.	924.	961.	2752.	2812.	2912.
OFFICE MACHINERY (714)	40.	89.	91.	91.	245.	252.	264.	721.	737.	767.	2207.	2255.	2336.
TYPEWRITERS (714.1)	12.	32.	33.	33.	89.	90.	95.	258.	264.	275.	792.	809.	838.
OFFICE MACHINES, NES (714.9)	9.	11.	12.	12.	29.	30.	31.	82.	84.	87.	249.	254.	263.
METAL WORKING MACHINERY (715)	49.	188.	196.	206.	694.	709.	737.	2689.	2744.	2840.	10485.	10721.	11093.
MACHINE TOOLS (715.1)	36.	155.	163.	171.	580.	593.	617.	2255.	2301.	2382.	8795.	8997.	9388.
TEXTILE MACHINERY (717.1)	170.	820.	859.	901.	3077.	3143.	3271.	11967.	12212.	12638.	46786.	47751.	49417.

Table III.4: OFFTREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS
(continued)
INDONESIA
(MILLIONS OF CURRENT U.S. DOLLARS)

PRODUCTS	1980	1985			1990			1995			2000		
	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
SKIN,LEATHER WORKING MACHINERY (717.2)	3.	9.	9.	10.	27.	28.	30.	82.	84.	88.	254.	260.	269.
SEWING MACHINERY (717.3)	31.	65.	66.	67.	182.	187.	196.	537.	549.	571.	1646.	1682.	1742.
SPECIAL INDUSTRIAL MACHINERY (718)	125.	1183.	1237.	1293.	4382.	4474.	4640.	16979.	17329.	17885.	66213.	67733.	69942.
PAPER AND PULP MACHINERY (718.1)	21.	56.	57.	57.	163.	168.	177.	491.	502.	522.	1513.	1546.	1602.
PRINTING MACHINERY (718.2)	27.	89.	93.	98.	327.	334.	347.	1263.	1285.	1334.	4923.	5034.	5209.
FOOD PROCESSING MACHINERY (718.3)	19.	99.	104.	107.	359.	367.	376.	1303.	1411.	1438.	5302.	5505.	5614.
CONSTRUCTION,MINING MACHINERY (718.4)	220.	497.	507.	510.	1377.	1415.	1484.	4056.	4147.	4313.	12429.	12633.	13154.
MINERAL AND GLASS WORKING MACHINERY (718.5)	38.	164.	171.	180.	598.	611.	640.	2311.	2358.	2459.	9004.	9287.	9599.
OTHER SPECIAL MACHINERY (7.3)	968.	2951.	3086.	3247.	11033.	11265.	11761.	42853.	43738.	45447.	167221.	171069.	177865.
HEATING,COOLING EQUIPMENT (719.1)	171.	511.	534.	563.	1906.	1945.	2036.	7398.	7551.	7861.	28865.	29523.	30763.
PUMPS AND CENTRIFUGES (719.2)	124.	515.	539.	563.	1917.	1957.	2029.	7435.	7589.	7831.	29004.	29670.	30634.
MECHANICAL HANDLING EQUIP (719.3)	124.	508.	532.	559.	1910.	1950.	2036.	7429.	7583.	7878.	29005.	29660.	30840.
POWERED-TOOLS,OTHER (719.5)	53.	55.	56.	56.	145.	146.	148.	407.	413.	423.	1166.	1190.	1226.
SPRAYING,VENDING, OTHER MACHINERY (719.6)	29.	112.	113.	113.	334.	338.	344.	984.	1001.	1026.	2895.	2910.	3008.
BALL,ROLLER BEARINGS (719.7)	19.	29.	30.	30.	80.	83.	87.	235.	241.	250.	728.	736.	762.
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	143.	469.	490.	517.	1716.	1751.	1837.	6623.	6760.	7060.	25909.	26400.	27595.
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	201.	557.	582.	517.	2113.	2157.	2266.	8240.	8410.	8792.	32180.	32929.	34445.

Table III.4: OFFTREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS
(continued)

INDONESIA

(MILLIONS OF CURRENT U.S. DOLLARS)

	1980	1985			1990			1995			2000		
PRODUCTS	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
TOTAL ELECTRICAL MACHINERY (72)	782.	1963.	2001.	2013.	3370.	5518.	5787.	15747.	16101.	16744.	48188.	49224.	50985.
ELECTRICAL POWER MACHINERY (722)	297.	703.	717.	722.	1961.	2015.	2114.	5789.	5920.	6157.	17755.	18140.	18798.
POWER TRANSFORMING MACHINERY (722.1)	224.	549.	560.	563.	1515.	1557.	1633.	4458.	4558.	4741.	13656.	13951.	14451.
SWITCH GEAR, ETC. (722.2)	73.	182.	185.	187.	510.	524.	550.	1510.	1544.	1607.	4637.	4737.	4907.
EQUIPMENT FOR DISTRIBUTIN ELECTRICITY (723)	158.	344.	350.	353.	949.	975.	1023.	2792.	2855.	2969.	8553.	8739.	9052.
INSULATED WIRE AND CABLE (723.1)	135.	303.	309.	310.	832.	855.	897.	2445.	2500.	2600.	7485.	7647.	7921.
ELECTRIC INSULATED EQUIPMENT (723.2)	24.	62.	63.	63.	181.	186.	195.	543.	556.	578.	1677.	1713.	1775.
ELECTRICAL MACHINERY OTHER (729)	141.	434.	442.	445.	1190.	1223.	1283.	3494.	3572.	3715.	10694.	10925.	11316.
BATTERIES AND ACCUMULATORS (729.1)	81.	170.	173.	174.	459.	471.	494.	1339.	1369.	1423.	4083.	4179.	4327.
ELECTRIC LAMPS (729.2)	13.	46.	47.	48.	132.	135.	142.	391.	400.	416.	1201.	1227.	1271.
VALVES, TUBES, ETC. (729.3)	15.	54.	55.	55.	157.	162.	170.	473.	484.	504.	1461.	1493.	1547.
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	25.	55.	56.	56.	164.	166.	169.	482.	490.	503.	1394.	1426.	1471.
MEASURING APPARATUS (729.5)	29.	305.	320.	337.	1199.	1225.	1276.	4721.	4818.	4987.	18484.	18980.	19555.
ELECTRO-MECHANICAL HAND TOOLS (729.6)	6.	25.	27.	28.	97.	99.	103.	379.	387.	401.	1483.	1516.	1569.
OTHERS, NES (729.9)	57.	253.	255.	256.	765.	775.	788.	2265.	2306.	2363.	6582.	6723.	6937.
TOTAL TRANSPORT EQUIPMENT (73)	1227.	4091.	4125.	4150.	12277.	12438.	12667.	36296.	36946.	37900.	105373.	107737.	111167.
RAILWAY VEHICLES (731)	296.	163.	164.	165.	493.	499.	508.	1461.	1487.	1524.	4243.	4343.	4488.

Table III.4: OFFTREND FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS
(continued)
INDONESIA
(MILLIONS OF CURRENT U.S. DOLLARS)

PRODUCTS	1980	1985			1990			1995			2000		
	ACTUAL VALUES	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH	LOW	MED	HIGH
LOCOMOTIVES, OTHER (731.3)	6.	55.	56.	56.	168.	171.	174.	500.	509.	523.	1494.	1487.	1534.
PASSENGERS, RAILWAY, TRAMWAY CARS (731.5)	12.	87.	87.	87.	261.	264.	268.	776.	788.	807.	2269.	2316.	2385.
RAILWAY, LOCOMOTIVE CAR PARTS, NES (731.7)	2.	7.	7.	7.	17.	18.	18.	47.	48.	49.	132.	135.	139.
BUSES (732.2)	31.	42.	43.	43.	95.	97.	98.	251.	255.	262.	699.	714.	736.
LORRIES AND TRUCKS (732.3)	186.	1605.	1619.	1529.	4899.	4764.	5057.	14562.	14824.	15211.	42351.	43301.	44690.
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	33.	71.	73.	73.	196.	202.	211.	576.	589.	613.	1764.	1803.	1867.
TRACTORS FOR TRAILERS (732.5)	12.	12.	12.	12.	12.	13.	13.	13.	14.	15.	9.	11.	13.
SHIPS AND BOATS (735)	35.	374.	381.	383.	1134.	1149.	1168.	3353.	3412.	3496.	9739.	9955.	10261.
SHIPS AND BOATS NON-WAR (735.3)	16.	72.	73.	73.	219.	222.	226.	649.	660.	677.	1887.	1929.	1989.
SHIPS AND BOATS NES (735.9)	17.	104.	105.	136.	232.	296.	302.	841.	856.	879.	2418.	2465.	2547.

SOURCE: ECONOMETRIC RESEARCH LTD.

3.3.3 The Long-Term Forecasts (2000)

Manufacturing value added is projected to reach 25 per cent of total GDP in the year 2000, and this assumption seems to result in some very substantial and perhaps infeasible demands for machinery. The total demand for non-electrical machinery is put at $ 82 billion for the low GDP scenario but jumps to $ 92 billion for the high GDP scenario. This translates into an annual rate of growth of over 20 per cent for the low GDP scenario between 1980 and 2000 and an annual rate of growth of 21.3 per cent for the high GDP scenario. Both of these rates are perhaps too high to sustain over such a long period. However, it is clear that any restructuring of the Indonesian economy with higher shares for manufacturing will *ipso facto* translate into large demands for machinery which would either be produced locally or have to be imported.

The demands for the various types of machinery are also projected to rise sharply; the demand for special industrial machinery is projected to exceed $ 16.7 billion for the medium GDP scenario in the year 2000; and that for other special machinery is put at $ 42.3 billion.

The off-trend forecasts are particularly tied to the specific assumptions about the structure of production envisaged, but such assumptions can be changed (scaled down) and other sets of forecasts generated. This is why we explained in detail the methodology and our assumption in the preceding sections. Indonesian planners may prefer a different profile or might be interested in the sensitivity of the forecasts to different assumptions.[10] These experiments can be easily performed.

3.4 Summary of Main Features of Demand Forecasting Results

There are three major dimensions to the forecasting results that reveal a number of interesting features of the expected pattern and structure of the demand for capital goods in Indonesia.

The first relates to the largest demand volumes expected. This aspect singles out the size of the expected market. Not surprisingly trucks and lorries dominate other demands for capital goods in the eighties and early nineties but fall to second rank below textile machinery in the year 2000 (see

Table III.5). Almost the same set of products dominate the list of the five largest demands for capital goods under both trend and off-trend hypotheses. However, there remains some important differences between the two, particularly in the lower ranks (see Tables III.5 and III.6).

Table III.5 Five largest expected demands for capital goods in Indonesia, 1985, 1990 and 2000, based on off-trend low forecast
(Ranked by volume)

Year 1985	1990	2000
1. Lorries and trucks 732.3	1. Lorries and trucks 732.3	1. Textiles machinery 717.1
2. Textile machinery 717.1	2. Textile machinery 717.1	2. Lorries and trucks 732.3
3. Engines, NES 711.8	3. Engines, NES 711.8	3. Engines, NES 711.8
4. Parts and accessories of machinery, NES 719.9	4. Parts and accessories of machinery, NES 719.9	4. Parts and accessories of machinery, NES 719.9
5. Power transforming machinery 722.1	5. Pumps and centrifuges 719.2	5. Mechanical handling equipment 719.3 and Pumps and centrifuges 719.2

Source: Based on Table III.3 of Part Two.

Table III.6 Five Largest expected demands for capital goods in Indonesia, 1985, 1990, and 2000, based on trend low forecast

Year 1985	1990	2000
1. Lorries and trucks 732.3	1. Lorries and trucks 732.3	1. Lorries and trucks 732.3
2. Textile machinery 717.1	2. Textile machinery 717.1	2. Textile machinery 717.1
3. Engines, NES 711.8	3. Engines, NES 711.8	3. Engines, NES 711.8
4. Power transforming machinery 722.1	4. Power transforming machinery 722.1	4. Parts and accessories of machinery, NES 719.9
5. Construction, mining machinery 718.4	5. Parts and accessories of machinery, NES 719.9	5. Power transforming machinery 722.1

Source: Based on Table III.1 of Part Two.

Although market size is an important indicator of magnitude and importance, the rates of growth of demand over the planning horizon is equally illuminating. The result of ranking demands for capital goods by their rate of growth show a number of product demands that are likely to assume importance in the next decade or two. Of particular importance are engines, ships, locomotives, measuring apparatus and food processing machinery (see Table III.7).

Table III.7 Five fastest growing expected demands for capital goods in Indonesia, 1985, 1990 and 2000
(Ranked by growth rates)

Year 1980-1985	1980-1990	1980-2000
1. Steam engines 711.3	1. Steam engines 711.3	1. Steam engines 711.3
2. Engines, NES 711.8	2. Engines, NES 711.8	2. Engines, NES 711.8
3. Ships and boats 735	3. Ships and boats 735	3. Measuring apparatus 729.9
4. Measuring apparatus 729.9	4. Ships and boats 735	4. Food processing 718.3
5. Locomotives, other 731.3	5. Locomotives, other 731.3	5. Ships and boats 735

Source: Based on the tables in Appendix 9 of Part Two detailing off-trend low growth rates.

Industrial planners will also be interested in the degree of sensitivity of expected demands for capital goods to the pace of overall economic growth. Of specific interest are those stable demands that will remain high irrespective of the general level of GDP growth. Almost 11 demands for capital goods in Indonesia over the period 1985-2000 will likely exhibit limited sensitivity to GDP growth fluctuations. These demands are presented in Table III.8. Among the most notable demands distinguished in the table are those for food processing machinery, engines, textile machinery, machine tools, mechanical tools, and transportation vehicles and boats.

Table III.8 Expected demands for capital goods in Indonesia that are insensitive to GDP growth rate fluctuations

1. Steam engines (711.3)
2. Engines, NES (711.8)
3. Textile machinery (717.1)
4. Machine tools (715.1)
5. Food processing machinery (718.3)
6. Pumps and centrifuges (719.2)
7. Measuring apparatus (729.5)
8. Electro-mechanical hand tools (729.6)
9. Passenger railway and tramway cars (731.5)
10. Lorries and trucks (732.5)
11. Ships and boats (735)

Source: Based on Table of Growth Rates 1980-2000 in Appendix 9.9 of Part Two.

3.5 Concluding Observations

There are two ways to illustrate the utility of our forecasts and the elements of a strategy for the development of a viable plant processing industry in Indonesia. The first involves drawing a master matrix which lists the products to the smallest available detail and then classifies each product according to the complexity of technology, the factor intensities involved, the infrastructure required, the size of the respective domestic, sub-regional and regional market, and the minimum viable scale of production. It is only within this broad framework that a comprehensive and comparative picture may be obtained. Alternatively, a detailed product by product discussion may be undertaken taking into consideration the relevant criteria developed above.

Footnotes

1/ Although it would have been desirable, it was not possible to treat replacement and new investment separately. Replacement investment will undoubtedly become more important when Indonesia expands its manufacturing sector. However, probably because replacement investment has been relatively unimportant over the data period, there is no data which can support separate treatment of these two types of investment. To the extent that replacement investment becomes more important, these forecasts may understate the future demand for capital goods.

2/ It is also necessary that the mix of inputs not change over time. Fixed ratios of capital goods input to gross output and gross output to value added are assumed.

3/ The demand for each capital good is measured in current US dollars, while GDP is measured in current Rupiah.

4/ See Appendix 7.

5/ The use of constant price data for the forecasts also requires conversion of export and domestic production data to constant prices, for products where these are significant. This conversion is difficult since there is no time series data on price indexes for capital goods for Indonesia. A second problem with forecasting in constant price terms is the difficulty of incorporating changes in the relative price of oil into forecasts of constant price GDP and GDP components. Changes in oil prices can be incorporated very naturally into forecasts computed in current prices.

6/ Poor results for two equations deserve special mention. The demand for agricultural machinery (SITC 712) is difficult to forecast by these methods because rapid mechanisation of agriculture (substitution of machinery for labour) may take place while, at the same time, agricultural output grows slowly (or not at all). Thus there is no strong relationship between output growth and demand for machinery in this sector. A second product where results are relatively poor (R^2 = 0.43) is food processing machinery. The forecasting equation for imports of this product was substantially better (R^2 = 0.64) than the equation for demand, suggesting possible problems with the data on domestic production.

7/ This result is surprising and may result from collinearity between the time trend variable and the oil-revenue variable. This collinearity will not seriously affect the forecasts so long as the growth of oil-revenues does not depart drastically from past trends.

8/ The forecasting equations fit well, as indicated by low estimated standard errors and high t-ratios, except for the agricultural sector. The output of this sector is extremely volatile, as a result of variation in weather conditions.

9/ These forecasts were based on targets desired by Indonesian planners.

10/ The differences between these forecasts and those presented in Tables III.1 and III.2 (the "Trend" forecasts) give some indication of the sensitivity of the results to changes in the forecast share of manufacturing.

APPENDIXES

APPENDIX 1

SECTOR CLASSIFICATION

GDP1:	Agriculture, hunting, forestry and fishing
GDP2:	Mining and quarrying
GDP3:	Manufacturing
GDP4:	Electricity, gas and water
GDP5:	Construction
GDP6:	Transport, storage and communication
GDP7:	Wholesale and retail trade
GDP8:	Services

APPENDIX 2
HISTORICAL GROSS DOMESTIC PRODUCT
INDONESIA
(MILLIONS OF RUPIAHS)

YEAR	AGRICULTURE	MINING	MANUFACTURING	ELECTRICITY	CONSTRUCTION	TRANSPORTATION	WHOLESALE & RETAIL TRADE	SERVICES
1967	457300.	22300.	62000.	3500.	14100.	18500.	140900.	120500.
1968	1074100.	87100.	178600.	9000.	44600.	57400.	352500.	282500.
1969	1339300.	123200.	250700.	12000.	74800.	76900.	475900.	359500.
1970	1575000.	172600.	311800.	15000.	100300.	95800.	618600.	451100.
1971	1646000.	294000.	307000.	18000.	128000.	162000.	592000.	525000.
1972	1837000.	491000.	448000.	20000.	174000.	187000.	769000.	643000.
1973	2710000.	831000.	653000.	30000.	262000.	257000.	1118000.	895000.
1974	3497000.	2374000.	890000.	52000.	406000.	442000.	1775000.	1272000.
1975	4303000.	2485000.	1124000.	70000.	590000.	521000.	2104000.	1746000.
1976	4912000.	2330000.	1453000.	98000.	813000.	663000.	2552000.	2145000.
1977	5306000.	3600000.	1817000.	106000.	1023000.	821000.	2959000.	2780000.
1978	6706000.	4358000.	2195000.	118000.	1242000.	980000.	3450000.	3420000.
1979	8994000.	6980000.	2614000.	149000.	1790000.	1300000.	4603000.	4603000.
1980	11253000.	11673000.	3846000.	225000.	2524000.	1706000.	6168000.	6370000.

SOURCE: ECONOMETRIC RESEARCH LTD.

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                                   APPENDIX 3
                          TREND FORECASTS OF SECTORAL GDP
                                   INDONESIA
                              (MILLIONS OF RUPIAHS)
---------------------------------------------------------------------------------------------------
  YEAR      GDP1        GDP2        GDP3        GDP4        GDP5        GDP6        GDP7        GDP8
---------------------------------------------------------------------------------------------------
                                                 LOW
                                                 ---
  1980   11253000.   11673000.    3846000.      22500.    2524000.    1706000.    6168000.    6370000.
  1985   21524800.   15651300.    9039550.     567302.    6831840.    4251130.   15505790.   20627600.
  1990   53791300.   18638000.   25643900.    1809970..  22426400.   13385300.   48798800.   77901900.
  1995  131880000.   17600000.   83313600.    5669390.   70921800.   41736400.  152151000.  277699000.
  2000  320987000.   17222700.  278679000.   17718900.  222328000.  130227000.  474744000.  955915000.
---------------------------------------------------------------------------------------------------
                                                MEDIUM
                                                ------
  1980   11253000.   11673000.    3846000.      22500.    2524000.    1706000.    6168000.    6370000.
  1985   21611800.   17236900.    9135340.     570099.    6859460.    4268320.   15568400.   20711000.
  1990   54326800.   23621800.   28929100.    1827990.   22649700.   13518500.   49284700.   78677500.
  1995  133725000.   24758300.   93562800.    5748690.   71913700.   42320200.  154279000.  281583000.
  2000  326773000.   26404600.  283703000.   18038300.  226335000.  132575000.  483302000.  973148000.
---------------------------------------------------------------------------------------------------
                                                 HIGH
                                                 ----
  1980   11253000.   11673000.    3846000.      22500.    2524000.    1706000.    6168000.    6370000.
  1985   21639700.   17758300.    9146730.     570805.    6868010.    4273640.   15587800.   20736800.
  1990   55122700.   33449000.   23358900.    1854770.   22931500.   13716600.   50006700.   79830100.
  1995  136536000.   40724600.   92467000.    5869560.   73425800.   43210000.  157523000.  287503000.
  2000  335509000.   49627100.  291287000.   18520500.  232386000.  136119000.  496888000.  999163000.
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  SOURCE:     ECONOMETRIC RESEARCH LTD.
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APPENDIX 4

OFFTREND FORECASTS OF SECTORAL GDP

INDONESIA

(MILLIONS OF RUPIAHS)

YEAR	GDP1	GDP2	GDP3	GDP4	GDP5	GDP6	GDP7	GDP9
				LOW				
1980	11253000.	11673000.	3846010.	22500.	2524000.	1706000.	6168000.	6370000.
1985	21135700.	15651300.	13351410.	557539.	6708350.	4174290.	15225400.	20254800.
1990	51834800.	18638000.	35577010.	1744140.	21610700.	12838400.	47053900.	75068400.
1995	122854000.	17760000.	135556010.	5281390.	66068000.	38880000.	141738000.	258693000.
2000	284088000.	17222700.	522603010.	15682000.	136770000.	115257000.	420170000.	846029000.
				MEDIUM				
1980	11253000.	11673000.	3846010.	22500.	2524000.	1706000.	6168000.	6370000.
1985	21169100.	17236900.	13560710.	558420.	6718960.	4180890.	15249500.	20286800.
1990	52187800.	23621800.	37602510.	1756010.	21757900.	12986300.	47344200.	75579700.
1995	124347000.	24758300.	133321010.	5345550.	66870600.	39352300.	143460000.	261836000.
2000	288919000.	26404600.	533341010.	15948700.	200116000.	117217000.	427315000.	860417000.
				HIGH				
1980	11253000.	11673000.	3846010.	22500.	2524000.	1706000.	6168000.	6370000.
1985	21178400.	17758300.	13624910.	558666.	6721910.	4182730.	15256200.	20295700.
1990	52630100.	33449000.	39460110.	1770300.	21942300.	13096300.	47745400.	76228200.
1995	126444000.	40724600.	144508010.	5435720.	67398500.	40016100.	145880000.	266252000.
2000	295906000.	49627100.	553082010.	16334400.	234356000.	120052000.	437650000.	881226000.

SOURCE: ECONOMETRIC RESEARCH LTD.

APPENDIX 5

GROSS DOMESTIC PRODUCT FORECASTS

INDONESIA

(MILLIONS OF RUPIAHS)

YEAR	TOTAL GDP LOW	MEDIUM	HIGH	NON-OIL GDP LOW	MEDIUM	HIGH
1980	43765000.	43765000.	43765000.	32092000.	32092000.	32092000
1981	43668406.	43668406.	43668406.	31218268.	31218268.	31218268
1982	48214308.	48214308.	49203915.	38758111.	38758111.	38897692
1983	61732767.	61732767.	62467907.	49244821.	49244521.	49346764
1984	76247154.	77033364.	77642688.	62158300.	62297000.	62360578
1985	94058740.	95961323.	96580806.	78407422.	78724405.	78822544
1986	114351180.	117847420.	119696160.	98620199.	99195193.	99521199
1987	140369130.	145138000.	148541530.	124042090.	124981870.	125648880
1988	173459500.	179612670.	184562440.	156016430.	157322060.	158625800
1989	214206980.	220394790.	229693140.	196199190.	197936970.	200268730
1990	255395460.	272836080.	286314300.	246757420.	249214320.	252865330
1991	328178450.	336888950.	352853800.	309750790.	313084340.	318085150
1992	407390830.	417365430.	436394920.	388847000.	393344980.	400163140
1993	516220380.	518439680.	541090670.	488150180.	494130280.	503391840
1994	633733150.	645339650.	672392580.	612826020.	620903030.	633216710
1995	787130800.	804830130.	837253380.	769370830.	790131840.	796534770
1996	983577730.	1005297830.	1044455100.	965945750.	990235780.	1002047600
1997	1230279100.	1257047530.	1304615400.	1212766800.	1231687700.	1260514800
1998	1540102900.	1573372830.	1531529400.	1522698200.	1547684700.	1585659300
1999	1929192500.	1970838730.	2342383700.	1911884000.	1944802200.	1994678900
2000	2417922000.	2470279200.	2559833500.	2400599300.	2443873600.	2589206400

SOURCE: ECONOMETRIC RESEARCH LTD.

APPENDIX 6

GROSS DOMESTIC PRODUCT FORECASTS

INDONESIA

(MILLIONS OF RUPIAHS)

OIL GDP

YEAR	LOW	MEDIUM	HIGH
1980	11573030.	11673000.	11673000.
1981	12450138.	12451139.	12450130.
1982	9456137.	9456197.	10305223.
1983	12487946.	12487346.	13121143.
1984	14359854.	14803364.	15274110.
1985	15551318.	17236913.	17758262.
1986	16233993.	19652232.	20174963.
1987	16927014.	20156139.	22892643.
1988	17443374.	21290609.	25936634.
1989	18107733.	22397822.	29424411.
1990	18638042.	23621766.	33448976.
1991	18427632.	23904608.	34774650.
1992	18343838.	24023456.	36231773.
1993	19070200.	24243393.	37598828.
1994	17907128.	24492622.	39175868.
1995	17759974.	24758239.	40724615.
1996	17631993.	25052045.	42407498.
1997	17512207.	25353798.	44101599.
1998	17434691.	25688071.	45869171.
1999	17308475.	26035440.	47710794.
2000	17222700.	26404580.	49627061.

SOURCE: ECONOMETRIC RESEARCH LTD.

Appendix 7

Comparison of Forecasting Equations for Imports in Current and Constant Prices

Products	GDP Component	R^2 Current Price	R^2 Constant Price
Total Engineering Products (7)	GDP3	.90	.82
Total Machinery non-electric (71)	GDP3	.90	.84
Total Electrical Machinery (72)	GDP (current level)	.88	.83
Power Generating Machinery (711)	GDP3	.82	.88
Boiler, Steam Generating Machinery (711.1)	GDP (current level)	.90	.80
Steam Engines (711.3)	GDP3	.41	.22
Aircraft Engines (711.4)	GDP (current level)	.34	.19
Other Internal Combustion Engines (711.5)	GDP (current level)	.90	.73
Nuclear Reactors (711.7)	GDP4	.76	.80
Engines, nes (711.8)	GDP3	.71	.89
Agricultural Machinery (712)	GDP (current level)	.16	.09
Office Machinery (714)	GDP (current level)	.90	.87
Typewriters (714.1)	GDP (current level)	.93	.79
Office Machines, nes (714.9)	GDP (current level)	.54	.14
Metal Working Machinery (715)	GDP3	.76	.78
Machine Tools (715.1)	GDP3	.51	.31
Textile and Leather Machinery (717)	GDP3	.77	.66
Textile Machinery (717.1)	GDP3	.74	.64
Skin, Leather Working Machinery (717.2)	GDP (current level)	.98	.94
Sewing Machinery (717.3)	GDP (current level)	.91	.59
Special Industrial Machinery (718)	GDP3	.84	.86
Paper and Pulp Machinery (718.1)	GDP (current level)	.86	.70
Food Processing Machinery (718.3)	GDP3	.64	.48
Construction, Mining Machinery (718.4)	GDP (current level)	.67	.65
Mineral and Glass Working Machinery (718.5)	GDP3	.76	.83
Other Special Machinery (719)	GDP3	.93	.81
Heating, Cooling Equipment (719.1)	GDP3	.95	.61

Appendix 7 (con't) ...

		R^2	
Products	Component	Current Price	Constant Price
Pumps and Centrifuges (719.2)	GDP3	.89	.79
Mechanical Handling Equipment (719.3)	GDP3	.86	.77
Powered Tools, Other (719.5)	GDP5	.72	.16
Spraying, Vending Other Machinery (719.6)	GDP5	.78	.10
Ball, Roller Bearings (719.7)	GDP (current level)	.93	.65
Machinery and Mechanical Appliances nes (719.8)	GDP3	.86	.74
Parts and Accessories of Machinery, nes (719.9)	GDP3	.97	.77
Electrical Power Machinery (722)	GDP (current level)	.90	.87
Equipment for Distributing Electricity (723)	GDP (current level)	.93	.88
Insulated Wire and Cable (723.1)	GDP (current level)	.90	.86
Electric Insulated Equipment (723.2)	GDP (current level)	.88	.76
Electrical Machinery Other (729)	GDP (current level)	.95	.86
Batteries and Accumulators (729.1)	GDP (current level)	.78	.48
Electric Lamps (729.2)	GDP (current level)	.88	.80
Valves, Tubes, etc. (729.3)	GDP (current level)	.81	.70
Automotive Electrical Equipment (729.4)	GDP6	.78	.55
Measuring Apparatus (729.5)	GDP3	.49	.48
Electro-Mechanical Hand Tools (729.6)	GDP3	.60	.74
Other Electrical, nes (729.9)	GDP5	.93	.20
Railway Vehicles (731)	GDP6	.59	.09
Locomotives, Other (731.3)	GDP6	.70	.56
Passenger: Railway, Tramway Cars (731.5)	GDP6	.61	.03
Railway, Locomotive Car Parts, nes (731.7)	GDP6	.11	.14
Buses (732.2)	GDP6	.05	.02
Lorries and Trucks (732.3)	GDP6	.88	.49
Special Purpose Lorries, Trucks and Vans (732.4)	GDP (current level)	.51	.48
Tractors for Trailers (732.5)	GDP6	.24	.003

Appendix 7 (con't) ...

Products	GDP Component	R^2 Current Price	R^2 Constant Price
Ships and Boats (735)	**GDP6**	**.69**	**.57**
Ships and Boats (non-war) (735.3)	**GDP6**	**.52**	**.44**
Ships and Boats, nes (735.9)	**GDP6**	**.51**	**.41**

Note: These equations forecast imports and, as a result, may differ from those reported in the text, which forecast domestic demand.

APPENDIX 8

"TREND" GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS IN INDONESIA (BASED ON CONSTANT US DOLLAR) (SEE TABLE III.1)

TABLE: GROWTH RATES CALCULATED
FROM THE FORECAST OF THE
APPARENT DEMAND FOR CAPITAL
GOODS FOR INDONESIA

1980 TO 1985	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	.149950	.157481	.159747
TOTAL MACHINERY NON-ELECTRIC (71)	.132435	.139848	.142186
POWER GENERATING MACHINERY (711)	.085016	.092087	.094492
BOILER,STEAM GENERATING MACHINERY (711.1)	-.057290	-.049772	-.049986
STEAM ENGINES (711.3)	.637096	.647722	.649466
AIR CRAFT ENGINES (711.4)	.056902	.064399	.065873
OTHER INTERNAL COMBUSTICN ENGINES (711.5)	.113496	.122532	.123272
NUCLEAR REACTORS (711.7)	.234110	.238664	.241634
ENGINES,NES (711.8)	.578598	.588923	.591754
AGRICULTURAL MACHINERY (712)	.170083	.178838	.179699
OFFICE MACHINERY (714)	.084837	.093097	.093803
TYPEWRITERS (714.1)	.122166	.130472	.131493
OFFICE MACHINES,NES (714.9)	.000079	.005288	.007853
METAL WORKING MACHINERY (715)	.158416	.165759	.167512
MACHINE TOOLS (715.1)	.190141	.197599	.199502
TEXTILE MACHINERY (717.1)	.213384	.221149	.223152
SKIN,LEATHER WORKING MACHINERY (717.2)	.128136	.135322	.135322

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               TABLE:     GROWTH RATES CALCULATED
                          FROM THE FORECAST OF THE
                          APPARENT DEMAND FOR CAPITAL
                          GOODS FOR INDONESIA

                            1980 TO 1985
                                            LOW           MED           HIGH
-----------------------------------------------------------------------------
     SEWING MACHINERY
     (717.3)                               .070103       .078339       .079816

     SPECIAL INDUSTRIAL
     MACHINERY                             .154853       .162366       .164549
     (718)
     PAPER AND PULP
     MACHINERY                             .119314       .128175       .129335
     (718.1)
     PRINTING MACHINERY
     (718.2)                               .128521       .135347       .137140

     FOOD PROCESSING
     MACHINERY                             .248343       .256472       .259156
     (718.3)
     CONSTRUCTION,MINING
     MACHINERY                             .085456       .093839       .094600
     (718.4)
     MINERAL AND GLASS
     WORKING MACHINERY                     .141350       .148396       .149604
     (718.5)
     OTHER SPECIAL
     MACHINERY                             .142924       .150440       .152876
     (719)
     HEATING,COOLING
     EQUIPMENT                             .114702       .122029       .124600
     (719.1)
     PUMPS AND CENTRIFUGES
     (719.2)                               .192556       .200426       .202516

     MECHANICAL HANDLING EQUIPMENT
     (719.3)                               .188057       .195966       .199322

     POWERED-TOOLS,OTHER
     (719.5)                              -.067471      -.062091      -.061126

     SPRAYING,VENDING,
     OTHER MACHINERY                       .214412       .222238       .223779
     (719.6)
     BALL,ROLLER BEARINGS
     (719.7)                               .005287       .013363       .014354

     MACHINERY AND MECHANICAL
     APPLIANCES,NES                        .144001       .151417       .153794
     (719.8)
     PARTS AND ACCESSORIES
     OF MACHINERY,NES                      .089320       .096572       .099379
     (719.9)
     TOTAL
     ELECTRICAL MACHINERY                  .108629       .117149       .117887
     (72)
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TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1985

	LOW	MED	HIGH
ELECTRICAL POWER MACHINERY (722)	.095819	.104371	.105139
POWER TRANSFORMING MACHINERY (722.1)	.103241	.111786	.112545
SWITCH GEAR, ETC. (722.2)	.105838	.114462	.115345
EQUIPMENT FOR DISTRIBUTING ELECTRICITY (723)	.077332	.085659	.086387
INSULATED WIRE AND CABLE (723.1)	.083828	.092284	.093012
ELECTRIC INSULATED EQUIPMENT (723.2)	.116608	.125718	.126771
ELECTRICAL MACHINERY OTHER (729)	.154824	.163699	.164471
BATTERIES AND ACCUMULATORS (729.1)	.069044	.077235	.077968
ELECTRIC LAMPS (729.2)	.114133	.123354	.124051
VALVES, TUBES, ETC. (729.3)	.197292	.207189	.207837
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	.087239	.094522	.095724
MEASURING APPARATUS (729.5)	.413703	.423027	.425528
ELECTRO-MECHANICAL HAND TOOLS (729.6)	.180529	.189023	.193693
OTHER, NES (729.9)	.248053	.256190	.257876
TOTAL TRANSPORT EQUIPMENT (73)	.179472	.187276	.189450
RAILWAY VEHICLES (731)	-.176061	-.170707	-.169283
LOCOMOTIVES, OTHER (731.3)	.445120	.454824	.457759

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1985	LOW	MED	HIGH
PASSENGERS: RAILWAY, TRAMWAY CARS (731.5)	.371025	.379277	.389633
RAILWAY,LOCOMOTIVE CAR PARTS, NES (731.7)	.160693	.170017	.170017
BUSES (732.2)	-.011237	-.005823	-.004487
LORRIES AND TRUCKS (732.3)	.426687	.436239	.439083
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	.077259	.085286	.096163
TRACTORS FOR TR-TRAILERS (732.5)	-.078347	-.071619	-.069419
SHIPS AND BOATS (735)	.492382	.502272	.504286
SHIPS AND BOATS NON-WAR (735.3)	.248495	.256401	.259831
SHIPS AND BOATS NES (735.9)	.341309	.350111	.352994

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1990

	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	.157949	.163533	.164905
TOTAL MACHINERY NON-ELECTRIC (71)	.149077	.154617	.156039
POWER GENERATING MACHINERY (711)	.123391	.128804	.133290
BOILER,STEAM GENERATING MACHINERY (711.1)	.040754	.047202	.051160
STEAM ENGINES (711.3)	.380969	.387529	.388875
AIR CRAFT ENGINES (711.4)	.099443	.106129	.113269
OTHER INTERNAL COMBUSTION ENGINES (711.5)	.132984	.140049	.144404
NUCLEAR REACTORS (711.7)	.197424	.203197	.204520
ENGINES,NES (711.8)	.366428	.373001	.374438
AGRICULTURAL MACHINERY (712)	.150535	.157494	.161668
OFFICE MACHINERY (714)	.112404	.119185	.123332
TYPEWRITERS (714.1)	.131567	.138253	.142605
OFFICE MACHINES,NES (714.9)	.059179	.065294	.068961
METAL WORKING MACHINERY (715)	.162538	.168069	.169267
MACHINE TOOLS (715.1)	.179662	.185249	.186459
TEXTILE MACHINERY (717.1)	.191592	.197282	.198509
SKIN,LEATHER WORKING MACHINERY	.141991	.148935	.153091

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1990

	LOW	MED	HIGH
SEWING MACHINERY (717.3)	.106259	.113086	.117199
SPECIAL INDUSTRIAL MACHINERY (718)	.160136	.165720	.167044
PAPER AND PULP MACHINERY (718.1)	.136766	.143846	.148265
PRINTING MACHINERY (718.2)	.146010	.151478	.152628
FOOD PROCESSING MACHINERY (718.3)	.203480	.209314	.210262
CONSTRUCTION,MINING MACHINERY (718.4)	.113491	.120330	.124493
MINERAL AND GLASS WORKING MACHINERY (718.5)	.148547	.154027	.154966
OTHER SPECIAL MACHINERY (719)	.155461	.161040	.162501
HEATING,COOLING EQUIPMENT (719.1)	.140800	.146308	.147839
PUMPS AND CENTRIFUGES (719.2)	.179873	.185554	.186838
MECHANICAL HANDLING EQUIPMENT (719.3)	.178850	.184540	.185937
POWERED-TOOLS,OTHER (719.5)	.029359	.034021	.034848
SPRAYING,VENDING, OTHER MACHINERY (719.6)	.190901	.196643	.197531
BALL,ROLLER BEARINGS (719.7)	.070134	.076776	.080747
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	.153642	.159200	.160654
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	.129601	.135063	.136753
TOTAL ELECTRICAL MACHINERY (72)	.123910	.130791	.134948

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1990	LOW	MED	HIGH
ELECTRICAL POWER MACHINERY (722)	.119472	.126363	.130561
POWER TRANSFORMING MACHINERY (722.1)	.122200	.129093	.133273
SWITCH GEAR, ETC. (722.2)	.125427	.132345	.135597
EQUIPMENT FOR DISTRIBUTING ELECTRICITY (723)	.108949	.115746	.119880
INSULATED WIRE AND CABLE (723.1)	.111833	.118660	.122776
ELECTRIC INSULATED EQUIPMENT (723.2)	.135946	.143132	.147501
ELECTRICAL MACHINERY OTHER (729)	.147368	.154395	.158648
BATTERIES AND ACCUMULATORS (729.1)	.102389	.109132	.113195
ELECTRIC LAMPS (729.2)	.130917	.137881	.142151
VALVES, TUBES, ETC. (729.3)	.176468	.183763	.189363
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	.125870	.131344	.132643
MEASURING APPARATUS (729.5)	.293429	.299625	.300981
ELECTRO-MECHANICAL HAND TOOLS (729.6)	.178206	.183822	.185280
OTHER, NES (729.9)	.208933	.214784	.215845
TOTAL TRANSPORT EQUIPMENT (73)	.174243	.179923	.181210
RAILWAY VEHICLES (731)	-.018014	-.013302	-.012241
LOCOMOTIVES, OTHER (731.3)	.301769	.308084	.309548

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1990

	LOW	MED	HIGH
PASSENGERS: RAILWAY, TRAMWAY CARS (731.5)	.265871	.271831	.272863
RAILWAY,LOCOMOTIVE CAR PARTS, NES (731.7)	.139696	.144889	.146155
BUSES (732.2)	.045022	.049765	.050816
LORRIES AND TRUCKS (732.3)	.293627	.299900	.301399
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	.108367	.115178	.119336
TRACTORS FOR TR-TRAILERS (732.5)	-.056621	-.052540	-.049904
SHIPS AND BOATS (735)	.320728	.327107	.328244
SHIPS AND BOATS NON-WAR (735.3)	.208718	.214550	.215813
SHIPS AND BOATS NES (735.9)	.243997	.250098	.251542

TABLE: GROWTH RATES CALCULATED
FROM THE FORECAST OF THE
APPARENT DEMAND FOR CAPITAL
GOODS FOR INDONESIA

1980 TO 2000	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	.163528	.168846	.169709
TOTAL MACHINERY NON-ELECTRIC (71)	.159058	.164354	.165246
POWER GENERATING MACHINERY (711)	.145725	.150962	.151903
BOILER,STEAM GENERATING MACHINERY (711.1)	.099998	.104983	.105924
STEAM ENGINES (711.3)	.270424	.276191	.277015
AIR CRAFT ENGINES (711.4)	.130022	.135100	.136074
OTHER INTERNAL COMBUSTION ENGINES (711.5)	.148168	.153370	.154359
NUCLEAR REACTORS (711.7)	.183082	.188460	.189248
ENGINES,NES (711.8)	.265764	.271513	.272355
AGRICULTURAL MACHINERY (712)	.154263	.159487	.160472
OFFICE MACHINERY (714)	.136202	.141352	.142317
TYPEWRITERS (714.1)	.145962	.151132	.152132
OFFICE MACHINES,NES (714.9)	.106403	.111388	.112354
METAL WORKING MACHINERY (715)	.165881	.171173	.171950
MACHINE TOOLS (715.1)	.174691	.180025	.180805
TEXTILE MACHINERY (717.1)	.180728	.186095	.185881
SKIN,LEATHER WORKING MACHINERY (717.2)	.153097	.158280	.159266

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 2000

	LOW	MED	HIGH
SEWING MACHINERY (717.3)	.133454	.138586	.139550
SPECIAL INDUSTRIAL MACHINERY (718)	.164564	.169884	.170724
PAPER AND PULP MACHINERY (718.1)	.150271	.155477	.156467
PRINTING MACHINERY (718.2)	.157272	.162534	.163298
FOOD PROCESSING MACHINERY (718.3)	.185532	.190934	.191596
CONSTRUCTION,MINING MACHINERY (718.4)	.136973	.142123	.143094
MINERAL AND GLASS WORKING MACHINERY (718.5)	.157641	.162902	.163608
OTHER SPECIAL MACHINERY (719)	.162507	.167820	.168725
HEATING,COOLING EQUIPMENT (719.1)	.155039	.160318	.161265
PUMPS AND CENTRIFUGES (719.2)	.174628	.179994	.180805
MECHANICAL HANDLING EQUIPMENT (719.3)	.174372	.179738	.180608
POWERED-TOOLS,OTHER (719.5)	.093474	.098411	.099083
SPRAYING,VENDING, OTHER MACHINERY (719.6)	.180097	.185485	.186121
BALL,ROLLER BEARINGS (719.7)	.114239	.119282	.120228
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	.161081	.166389	.167302
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	.149762	.155020	.156043
TOTAL ELECTRICAL MACHINERY (72)	.141911	.147081	.148056

TABLE: GROWTH RATES CALCULATED
FROM THE FORECAST OF THE
APPARENT DEMAND FOR CAPITAL
GOODS FOR INDONESIA

1980 TO 2000

	LOW	MED	HIGH
ELECTRICAL POWER MACHINERY (722)	.140191	.145355	.146331
POWER TRANSFORMING MACHINERY (722.1)	.141307	.146475	.147450
SWITCH GEAR, ETC. (722.2)	.143423	.148603	.149581
EQUIPMENT FOR DISTRIBUTING ELECTRICITY (723)	.134550	.139688	.140656
INSULATED WIRE AND CABLE (723.1)	.135907	.141048	.142019
ELECTRIC INSULATED EQUIPMENT (723.2)	.150018	.155230	.156218
ELECTRICAL MACHINERY OTHER (729)	.153838	.159061	.160047
BATTERIES AND ACCUMULATORS (729.1)	.130598	.135712	.136678
ELECTRIC LAMPS (729.2)	.146485	.151675	.152654
VALVES,TUBES, ETC. (729.3)	.170302	.175607	.176618
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	.147307	.152565	.153387
MEASURING APPARATUS (729.5)	.231533	.237126	.237942
ELECTRO-MECHANICAL HAND TOOLS (729.6)	.174707	.180046	.180833
OTHER,NES (729.9)	.189370	.194807	.195495
TOTAL TRANSPORT EQUIPMENT (73)	.172019	.177378	.178186
RAILWAY VEHICLES (731)	.071900	.076790	.077522
LOCOMOTIVES, OTHER (731.3)	.234439	.240084	.240964

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 2000	LOW	MED	HIGH
PASSENGERS: RAILWAY, TRAMWAY CARS (731.5)	.216765	.222232	.222979
RAILWAY, LOCOMOTIVE CAR PARTS, NES (731.7)	.148519	.153708	.154554
BUSES (732.2)	.097395	.102402	.103166
LORRIES AND TRUCKS (732.3)	.230591	.236221	.237096
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	.134173	.139298	.143274
TRACTORS FOR TRAILERS (732.5)	-.006457	-.000329	.002093
SHIPS AND BOATS (735)	.242944	.248621	.249328
SHIPS AND BOATS NON-WAR (735.3)	.189218	.194636	.195449
SHIPS AND BOATS NES (735.9)	.204621	.210172	.211071

SOURCE: ECONOMETRIC RESEARCH LTD.

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1985 TO 1990

	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	.166003	.169616	.170085
TOTAL MACHINERY NON-ELECTRIC (71)	.165963	.169577	.170060
POWER GENERATING MACHINERY (711)	.163124	.166756	.167260
BOILER,STEAM GENERATING MACHINERY (711.1)	.148995	.154073	.161852
STEAM ENGINES (711.3)	.164914	.168424	.169454
AIR CRAFT ENGINES (711.4)	.143697	.149495	.156513
OTHER INTERNAL COMBUSTION ENGINES (711.5)	.152814	.157840	.165933
NUCLEAR REACTORS (711.7)	.164659	.168746	.168515
ENGINES,NES (711.8)	.182774	.186421	.186791
AGRICULTURAL MACHINERY (712)	.131313	.136536	.143913
OFFICE MACHINERY (714)	.140672	.145897	.153658
TYPEWRITERS (714.1)	.141047	.146088	.153827
OFFICE MACHINES,NES (714.9)	.121771	.128881	.133775
METAL WORKING MACHINERY (715)	.166676	.170383	.171024
MACHINE TOOLS (715.1)	.169275	.173027	.173558
TEXTILE MACHINERY (717.1)	.170190	.173881	.174362
SKIN,LEATHER WORKING MACHINERY (717.2)	.156015	.162711	.171137

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1985 TO 1990	LOW	MED	HIGH
SEWING MACHINERY (717.3)	.143637	.148952	.156947
SPECIAL INDUSTRIAL MACHINERY (718)	.165444	.169084	.169545
PAPER AND PULP MACHINERY (718.1)	.154491	.159734	.167511
PRINTING MACHINERY (718.2)	.163770	.167839	.168327
FOOD PROCESSING MACHINERY (718.3)	.160231	.163927	.164192
CONSTRUCTION,MINING MACHINERY (718.4)	.142250	.147462	.155203
MINERAL AND GLASS WORKING MACHINERY (718.5)	.155790	.159686	.160353
OTHER SPECIAL MACHINERY (719)	.168136	.171738	.172207
HEATING,COOLING EQUIPMENT (719.1)	.167510	.171113	.171558
PUMPS AND CENTRIFUGES (719.2)	.167325	.170867	.171364
MECHANICAL HANDLING EQUIPMENT (719.3)	.169715	.173223	.173681
POWERED-TOOLS,OTHER (719.5)	.136243	.139981	.140633
SPRAYING,VENDING, OTHER MACHINERY (719.6)	.167844	.171584	.171846
BALL,ROLLER BEARINGS (719.7)	.139164	.144158	.151486
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	.163364	.167037	.167554
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	.171371	.174904	.175398
TOTAL ELECTRICAL MACHINERY (72)	.139401	.144600	.152269

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1985 TO 1990

	LOW	MED	HIGH
ELECTRICAL POWER MACHINERY (722)	.143636	.148793	.156567
POWER TRANSFORMING MACHINERY (722.1)	.141486	.146669	.154388
SWITCH GEAR, ETC. (722.2)	.145362	.150516	.159254
EQUIPMENT FOR DISTRIBUTING ELECTRICITY (723)	.141495	.146667	.154406
INSULATED WIRE AND CABLE (723.1)	.140562	.145673	.153351
ELECTRIC INSULATED EQUIPMENT (723.2)	.155619	.160815	.169613
ELECTRICAL MACHINERY OTHER (729)	.139959	.145165	.152854
BATTERIES AND ACCUMULATORS (729.1)	.136773	.141972	.149574
ELECTRIC LAMPS (729.2)	.147954	.152596	.160543
VALVES,TUBES, ETC. (729.3)	.156005	.160793	.169203
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	.165872	.169404	.169739
MEASURING APPARATUS (729.5)	.183387	.186924	.187315
ELECTRO-MECHANICAL HAND TOOLS (729.6)	.175888	.178645	.179892
OTHER,NES (729.9)	.171039	.174742	.175219
TOTAL TRANSPORT EQUIPMENT (73)	.169038	.172614	.173028
RAILWAY VEHICLES (731)	.170350	.173978	.174490
LOCOMOTIVES, OTHER (731.3)	.172638	.176145	.175406

TABLE: GROWTH RATES CALCULATED
FROM THE FORECAST OF THE
APPARENT DEMAND FOR CAPITAL
GOODS FOR INDONESIA

1985 TO 1990	LOW	MED	HIGH
PASSENGERS: RAILWAY, TRAMWAY CARS (731.5)	.168781	.172756	.173506
RAILWAY,LOCOMOTIVE CAR PARTS, NES (731.7)	.119078	.120300	.122779
BUSES (732.2)	.104483	.108460	.109191
LORRIES AND TRUCKS (732.3)	.172977	.176504	.176888
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	.140374	.145894	.153521
TRACTORS FOR TR-TRAILERS (732.5)	-.034383	-.033068	-.029980
SHIPS AND BOATS (735)	.168818	.172367	.172804
SHIPS AND BOATS NON-WAR (735.3)	.170207	.174093	.174264
SHIPS AND BOATS NES (735.9)	.153745	.157494	.157697

TABLE: GROWTH RATES CALCULATED
FROM THE FOFECAST OF THE
APPARENT DEMAND FOR CAPITAL
GOODS FOR INDCNESIA

1990 TO 2000

	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	.169135	.174183	.174533
TOTAL MACHINERY NON-ELECTRIC (71)	.169126	.174174	.174527
POWER GENERATING MACHINERY (711)	.168503	.173555	.173930
BOILER,STEAM GENERATING MACHINERY (711.1)	.162613	.165951	.163540
STEAM ENGINES (711.3)	.168727	.173786	.174165
AIR CRAFT ENGINES (711.4)	.161451	.164830	.162480
OTHER INTERNAL COMBUSTION ENGINES (711.5)	.163555	.166846	.164401
NUCLEAR REACTORS (711.7)	.168912	.173903	.174169
ENGINES,NES (711.8)	.172516	.177526	.177854
AGRICULTURAL MACHINERY (712)	.158003	.161483	.159276
OFFICE MACHINERY (714)	.160508	.163958	.161623
TYPEWRITERS (714.1)	.160541	.164157	.161738
OFFICE MACHINES,NES (714.9)	.155734	.159478	.157508
METAL WORKING MACHINERY (715)	.169233	.174286	.174639
MACHINE TOOLS (715.1)	.169742	.174824	.175178
TEXTILE MACHINERY (717.1)	.169964	.175013	.175367
SKIN,LEATHER WORKING MACHINERY (717.2)	.164310	.167702	.165475

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1990 TO 2000	LOW	MED	HIGH
SEWING MACHINERY (717.3)	.161318	.164669	.162349
SPECIAL INDUSTRIAL MACHINERY (718)	.169009	.174062	.174415
PAPER AND PULP MACHINERY (718.1)	.163935	.167227	.164728
PRINTING MACHINERY (718.2)	.168645	.173695	.174067
FOOD PROCESSING MACHINERY (718.3)	.167850	.172832	.173218
CONSTRUCTION, MINING MACHINERY (718.4)	.160951	.164340	.162003
MINERAL AND GLASS WORKING MACHINERY (718.5)	.166806	.171845	.172315
OTHER SPECIAL MACHINERY (719)	.169596	.174640	.174982
HEATING, COOLING EQUIPMENT (719.1)	.169454	.174500	.174847
PUMPS AND CENTRIFUGES (719.2)	.169407	.174460	.174803
MECHANICAL HANDLING EQUIPMENT (719.3)	.169911	.174956	.175302
POWERED-TOOLS, OTHER (719.5)	.161583	.166810	.167304
SPRAYING, VENDING, OTHER MACHINERY (719.6)	.169391	.174430	.174819
BALL, ROLLER BEARINGS (719.7)	.160161	.163465	.161151
MACHINERY AND MECHANICAL APPLIANCES, NES (719.8)	.168567	.173621	.173988
PARTS AND ACCESSORIES OF MACHINERY, NES (719.9)	.170284	.175328	.175659
TOTAL ELECTRICAL MACHINERY (72)	.160200	.163606	.161317

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1990 TO 2000

	LOW	MED	HIGH
ELECTRICAL POWER MACHINERY (722)	.161293	.164668	.162321
POWER TRANSFORMING MACHINERY (722.1)	.160739	.164125	.161804
SWITCH GEAR, ETC. (722.2)	.161707	.165095	.162714
EQUIPMENT FOR DISTRIBUTIN ELECTRICITY (723)	.160741	.164143	.161817
INSULATED WIRE AND CABLE (723.1)	.160503	.163885	.161591
ELECTRIC INSULATED EQUIPMENT (723.2)	.164265	.167456	.165001
ELECTRICAL MACHINERY OTHER (729)	.160345	.163747	.161448
BATTERIES AND ACCUMULATORS (729.1)	.159529	.162929	.160655
ELECTRIC LAMPS (729.2)	.162266	.165636	.163254
VALVES, TUBES, ETC. (729.3)	.164170	.167506	.164990
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	.169152	.174184	.174512
MEASURING APPARATUS (729.5)	.172599	.177633	.177958
ELECTRO-MECHANICAL HAND TOOLS (729.6)	.171219	.176281	.175403
OTHER, NES (729.9)	.170123	.175160	.175486
TOTAL TRANSPORT EQUIPMENT (73)	.169799	.174839	.175169
RAILWAY VEHICLES (731)	.170047	.175108	.175442
LOCOMOTIVES, OTHER (731.3)	.170591	.175619	.175971

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1990 TO 2000	LOW	MED	HIGH
PASSENGERS: RAILWAY, TRAMWAY CARS (731.5)	.169565	.174567	.175049
RAILWAY LOCOMOTIVE CAR PARTS, NES (731.7)	.157411	.162595	.163016
BUSES (732.2)	.152393	.157679	.159125
LORRIES AND TRUCKS (732.3)	.170627	.175661	.175971
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	.160580	.163939	.161605
TRACTORS FOR TR-TRAILERS (732.5)	.046375	.054758	.056935
SHIPS AND BOATS (735)	.169741	.174777	.175101
SHIPS AND BOATS NON-WAR (735.3)	.170034	.175048	.175426
SHIPS AND BOATS NES (735.9)	.166492	.171521	.171909

SOURCE: ECONOMETRIC RESEARCH LTD.

APPENDIX 9

"OFF-TREND" GROWTH RATES CALCULATED FROM
THE FORECAST OF THE APPARENT DEMAND FOR
CAPITAL GOODS FOR INDONESIA
(BASED ON CONSTANT US DOLLAR)
(SEE TABLE III.3)

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1985	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	.183389	.198454	.209031
TOTAL MACHINERY NON-ELECTRIC (71)	.169073	.183984	.194733
POWER GENERATING MACHINERY (711)	.122680	.136862	.147018
BOILER,STEAM GENERATING MACHINERY (711.1)	-.057290	-.049772	-.043986
STEAM ENGINES (711.3)	.700213	.722008	.737129
AIR CRAFT ENGINES (711.4)	.056902	.064399	.065873
OTHER INTERNAL COMBUSTION ENGINES (711.5)	.113496	.122532	.123272
NUCLEAR REACTORS (711.7)	.224931	.231110	.231110
ENGINES,NES (711.8)	.646789	.669607	.685342
AGRICULTURAL MACHINERY (712)	.170083	.178838	.179699
OFFICE MACHINERY (714)	.084837	.093097	.093803
TYPEWRITERS (714.1)	.122166	.130472	.131493
OFFICE MACHINES,NES (714.9)	.000079	.005288	.007853
METAL WORKING MACHINERY (715)	.204807	.220568	.231171
MACHINE TOOLS (715.1)	.238136	.254417	.265549
TEXTILE MACHINERY (717.1)	.263293	.279974	.291377
SKIN,LEATHER WORKING MACHINERY (717.2)	.128136	.135322	.135322

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1985

	LOW	MED	HIGH
SEWING MACHINERY (717.3)	.070103	.078339	.079816
SPECIAL INDUSTRIAL MACHINERY (718)	.194276	.209493	.213505
PAPER AND PULP MACHINERY (718.1)	.119314	.128175	.129335
PRINTING MACHINERY (718.2)	.173204	.188571	.198873
FOOD PROCESSING MACHINERY (718.3)	.283961	.300200	.307845
CONSTRUCTION,MINING MACHINERY (718.4)	.085456	.093839	.094600
MINERAL AND GLASS WORKING MACHINERY (718.5)	.235059	.250933	.262951
OTHER SPECIAL MACHINERY (719)	.178000	.193125	.204646
HEATING,COOLING EQUIPMENT (719.1)	.148093	.162791	.174393
PUMPS AND CENTRIFUGES (719.2)	.226172	.241822	.252226
MECHANICAL HANDLING EQUIPMENT (719.3)	.222873	.238618	.250648
POWERED-TOOLS,OTHER (719.5)	-.070960	-.066483	-.065483
SPRAYING,VENDING, OTHER MACHINERY (719.6)	.208003	.214412	.215046
BALL,ROLLER BEARINGS (719.7)	.005287	.013363	.014354
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	.169686	.184333	.195656
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	.130592	.145307	.157866
TOTAL ELECTRICAL MACHINERY (72)	.108629	.117149	.117887

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1985	LOW	MED	HIGH
ELECTRICAL POWER MACHINERY (722)	.095819	.104371	.105139
POWER TRANSFORMING MACHINERY (722.1)	.103241	.111786	.112545
SWITCH GEAR, ETC. (722.2)	.105838	.114462	.115345
EQUIPMENT FOR DISTRIBUTING ELECTRICITY (723)	.077332	.085659	.085387
INSULATED WIRE AND CABLE (723.1)	.083828	.092284	.093012
ELECTRIC INSULATED EQUIPMENT (723.2)	.116608	.125718	.126771
ELECTRICAL MACHINERY OTHER (729)	.154824	.163699	.164471
BATTERIES AND ACCUMULATORS (729.1)	.069044	.077235	.077968
ELECTRIC LAMPS (729.2)	.114133	.123354	.124051
VALVES, TUBES, ETC. (729.3)	.197292	.207189	.207837
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	.079756	.085531	.086671
MEASURING APPARATUS (729.5)	.474542	.495147	.509160
ELECTRO-MECHANICAL HAND TOOLS (729.6)	.231147	.248154	.258997
OTHER, NES (729.9)	.242067	.248776	.249352
TOTAL TRANSPORT EQUIPMENT (73)	.173396	.179884	.180615
RAILWAY VEHICLES (731)	-.181408	-.176943	-.176502
LOCOMOTIVES, OTHER (731.3)	.435147	.442843	.443603

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      TABLE:   GROWTH RATES CALCULATED
               FROM THE FORECAST OF THE
               APPARENT DEMAND FOR CAPITAL
               GOODS FOR INDONESIA

                 1980 TO 1985
                                LOW           MED          HIGH
-----------------------------------------------------------------
    PASSENGERS: RAILWAY,
    TRAMWAY CARS               .364940       .371489       .371489
    (731.5)
    RAILWAY,LOCOMOTIVE
    CAR PARTS, NES             .155916       .160693       .160693
    (731.7)
    BUSES
    (732.2)                   -.016074      -.010554      -.010554

    LORRIES AND TRUCKS
    (732.3)                    .419212       .427127       .428111

    SPECIAL PURPOSE LORRIES,
    TRUCKS AND VANS            .077259       .085286       .085163
    (732.4)

    TRACTORS FOR TR-          -.085277      -.078347      -.078347
    TRAILERS
    (732.5)
    SHIPS AND BOATS            .484465       .492497       .493072
    (735)

    SHIPS AND BOATS            .240384       .246991       .247493
    NON-WAR
    (735.3)
    SHIPS AND BOATS            .331507       .339073       .340193
    NES (735.9)
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TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1990	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	.196901	.203453	.206876
TOTAL MACHINERY NON-ELECTRIC (71)	.189794	.196311	.193880
POWER GENERATING MACHINERY (711)	.164806	.171180	.174647
BOILER,STEAM GENERATING MACHINERY (711.1)	.040754	.047202	.051160
STEAM ENGINES (711.3)	.433202	.441085	.445355
AIR CRAFT ENGINES (711.4)	.099443	.106129	.110269
OTHER INTERNAL COMBUSTION ENGINES (711.5)	.132984	.140049	.144404
NUCLEAR REACTORS (711.7)	.189927	.195677	.196378
ENGINES,NES (711.8)	.420214	.428133	.432396
AGRICULTURAL MACHINERY (712)	.150535	.157494	.161668
OFFICE MACHINERY (714)	.112404	.119185	.123332
TYPEWRITERS (714.1)	.131567	.138253	.142605
OFFICE MACHINES,NES (714.9)	.059179	.065294	.068961
METAL WORKING MACHINERY (715)	.207558	.214228	.217754
MACHINE TOOLS (715.1)	.225268	.232040	.235638
TEXTILE MACHINERY (717.1)	.238198	.245038	.248670
SKIN,LEATHER WORKING MACHINERY (717.2)	.141991	.148935	.153091

TABLE: GROWTH RATES CALCULATED
FROM THE FORECAST OF THE
APPARENT DEMAND FOR CAPITAL
GOODS FOR INDONESIA

1980 TO 1990	LOW	MED	HIGH
SEWING MACHINERY (717.3)	.106259	.113086	.117199
SPECIAL INDUSTRIAL MACHINERY (718)	.202358	.208948	.212057
PAPER AND PULP MACHINERY (718.1)	.136766	.143846	.148265
PRINTING MACHINERY (718.2)	.190509	.197033	.200540
FOOD PROCESSING MACHINERY (718.3)	.243676	.250528	.252207
CONSTRUCTION,MINING MACHINERY (718.4)	.113491	.120330	.124493
MINERAL AND GLASS WORKING MACHINERY (718.5)	.221148	.227866	.232274
OTHER SPECIAL MACHINERY (719)	.195272	.201822	.205721
HEATING,COOLING EQUIPMENT (719.1)	.179685	.186145	.190209
PUMPS AND CENTRIFUGES (719.2)	.218881	.225559	.228703
MECHANICAL HANDLING EQUIPMENT (719.3)	.218459	.225144	.223106
POWERED-TOOLS.OTHER (719.5)	.023896	.028491	.028926
SPRAYING,VENDING, OTHER MACHINERY (719.6)	.183391	.188954	.189678
BALL,ROLLER BEARINGS (719.7)	.070134	.076776	.083747
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	.188406	.194886	.193332
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	.172771	.179212	.183770
TOTAL ELECTRICAL MACHINERY (72)	.123910	.130791	.134948

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 1990	LOW	MED	HIGH
ELECTRICAL POWER MACHINERY (722)	.119472	.126363	.133561
POWER TRANSFORMING MACHINERY (722.1)	.122200	.129093	.133273
SWITCH GEAR, ETC. (722.2)	.125427	.132345	.136597
EQUIPMENT FOR DISTRIBUTING ELECTRICITY (723)	.108949	.115746	.119880
INSULATED WIRE AND CABLE (723.1)	.111833	.118660	.122776
ELECTRIC INSULATED EQUIPMENT (723.2)	.135946	.143132	.147501
ELECTRICAL MACHINERY OTHER (729)	.147368	.154395	.158648
BATTERIES AND ACCUMULATORS (729.1)	.102389	.109132	.113195
ELECTRIC LAMPS (729.2)	.130917	.137881	.142151
VALVES, TUBES, ETC. (729.3)	.176468	.183763	.189363
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	.117692	.122970	.123944
MEASURING APPARATUS (729.5)	.344174	.351648	.355716
ELECTRO-MECHANICAL HAND TOOLS (729.6)	.224819	.231659	.233205
OTHER, NES (729.9)	.201713	.207366	.208168
TOTAL TRANSPORT EQUIPMENT (73)	.167015	.172494	.173380
RAILWAY VEHICLES (731)	-.024574	-.020022	-.013335
LOCOMOTIVES, OTHER (731.3)	.292568	.298662	.293601

TABLE: GROWTH RATES CALCULATED
FROM THE FORECAST OF THE
APPARENT DEMAND FOR CAPITAL
GOODS FOR INDONESIA

1980 TO 1990	LOW	MED	HIGH
PASSENGERS: RAILWAY, TRAMWAY CARS (731.5)	.259235	.264984	.265477
RAILWAY,LOCOMOTIVE CAR PARTS, NES (731.7)	.132889	.138363	.139363
BUSES (732.2)	.038693	.043249	.043917
LORRIES AND TRUCKS (732.3)	.285606	.291663	.292686
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	.108367	.115178	.119336
TRACTORS FOR TR-TRAILERS (732.5)	-.071508	-.066814	-.065295
SHIPS AND BOATS (735)	.312510	.318657	.319484
SHIPS AND BOATS NON-WAR (735.3)	.200642	.206267	.207163
SHIPS AND BOATS NES (735.9)	.234490	.240325	.241445

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 2000	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	.209525	.215082	.216105
TOTAL MACHINERY NON-ELECTRIC (71)	.209957	.211497	.212601
POWER GENERATING MACHINERY (711)	.193027	.198507	.199595
BOILER,STEAM GENERATING MACHINERY (711.1)	.099998	.104983	.105924
STEAM ENGINES (711.3)	.323373	.329418	.330469
AIR CRAFT ENGINES (711.4)	.130022	.135100	.136074
OTHER INTERNAL COMBUSTION ENGINES (711.5)	.148168	.153370	.154359
NUCLEAR REACTORS (711.7)	.172210	.177511	.179255
ENGINES,NES (711.8)	.318850	.324880	.325934
AGRICULTURAL MACHINERY (712)	.154263	.159487	.160472
OFFICE MACHINERY (714)	.136202	.141352	.142317
TYPEWRITERS (714.1)	.145962	.151132	.152132
OFFICE MACHINES,NES (714.9)	.106403	.111388	.112354
METAL WORKING MACHINERY (715)	.214909	.220463	.221435
MACHINE TOOLS (715.1)	.223975	.229569	.231546
TEXTILE MACHINERY (717.1)	.230502	.236131	.237115
SKIN,LEATHER WORKING MACHINERY (717.2)	.153097	.158280	.159266

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 2000

	LOW	MED	HIGH
SEWING MACHINERY (717.3)	.133454	.138586	.139550
SPECIAL INDUSTRIAL MACHINERY (718)	.212278	.217844	.218693
PAPER AND PULP MACHINERY (718.1)	.150271	.155477	.156467
PRINTING MACHINERY (718.2)	.206082	.211598	.212565
FOOD PROCESSING MACHINERY (718.3)	.232418	.238071	.238162
CONSTRUCTION,MINING MACHINERY (718.4)	.136973	.142123	.143094
MINERAL AND GLASS WORKING MACHINERY (718.5)	.221467	.227051	.228497
OTHER SPECIAL MACHINERY (719)	.208893	.214447	.215710
HEATING,COOLING EQUIPMENT (719.1)	.200930	.206448	.207822
PUMPS AND CENTRIFUGES (719.2)	.220676	.226284	.227129
MECHANICAL HANDLING EQUIPMENT (719.3)	.220670	.226279	.227541
POWERED-TOOLS,OTHER (719.5)	.084122	.088989	.089615
SPRAYING,VENDING, OTHER MACHINERY (719.6)	.168982	.174310	.175015
BALL,ROLLER BEARINGS (719.7)	.114239	.119282	.120228
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	.204945	.210484	.212066
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	.197772	.203275	.204892
TOTAL ELECTRICAL MACHINERY (72)	.141911	.147081	.148056

TABLE: GROWTH RATES CALCULATED
FROM THE FORECAST OF THE
APPARENT DEMAND FOR CAPITAL
GOODS FOR INDONESIA

1980 TO 2000	LOW	MED	HIGH
ELECTRICAL POWER MACHINERY (722)	.140191	.145355	.146331
POWER TRANSFORMING MACHINERY (722.1)	.141307	.146475	.147450
SWITCH GEAR, ETC. (722.2)	.143423	.148603	.149581
EQUIPMENT FOR DISTRIBUTING ELECTRICITY (723)	.134550	.139688	.140656
INSULATED WIRE AND CABLE (723.1)	.135907	.141048	.142019
ELECTRIC INSULATED EQUIPMENT (723.2)	.150018	.155230	.156218
ELECTRICAL MACHINERY OTHER (729)	.153838	.159061	.160047
BATTERIES AND ACCUMULATORS (729.1)	.130598	.135712	.136678
ELECTRIC LAMPS (729.2)	.146485	.151675	.152654
VALVES, TUBES, ETC. (729.3)	.170302	.175607	.176618
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	.135744	.140951	.141707
MEASURING APPARATUS (729.5)	.283089	.288955	.289979
ELECTRO-MECHANICAL HAND TOOLS (729.6)	.224290	.229893	.230870
OTHER, NES (729.9)	.178346	.183722	.184450
TOTAL TRANSPORT EQUIPMENT (73)	.161033	.166332	.167100
RAILWAY VEHICLES (731)	.061698	.066531	.067208
LOCOMOTIVES, OTHER (731.3)	.222224	.227823	.228636

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1980 TO 2000	LOW	MED	HIGH
PASSENGERS: RAILWAY, TRAMWAY CARS (731.5)	.206768	.212180	.212854
RAILWAY,LOCOMOTIVE CAR PARTS, NES (731.7)	.137138	.142330	.143013
BUSES (732.2)	.086633	.091574	.092250
LORRIES AND TRUCKS (732.3)	.219037	.224603	.225424
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	.134173	.139298	.140274
TRACTORS FOR TR-TRAILERS (732.5)	-.082000	-.072560	-.064648
SHIPS AND BOATS (735)	.231320	.236930	.237675
SHIPS AND BOATS NON-WAR (735.3)	.177962	.183312	.184065
SHIPS AND BOATS NES (735.9)	.191816	.197303	.198152

SOURCE: ECONOMETRIC RESEARCH LTD.

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1985 TO 1990

	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	.210567	.208473	.204726
TOTAL MACHINERY NON-ELECTRIC (71)	.210883	.208766	.205048
POWER GENERATING MACHINERY (711)	.208512	.206534	.202941
BOILER,STEAM GENERATING MACHINERY (711.1)	.148995	.154073	.161852
STEAM ENGINES (711.3)	.208124	.205992	.202589
AIR CRAFT ENGINES (711.4)	.143697	.149495	.156513
OTHER INTERNAL COMBUSTION ENGINES (711.5)	.152814	.157840	.165933
NUCLEAR REACTORS (711.7)	.155923	.161263	.162626
ENGINES,NES (711.8)	.224812	.221584	.217413
AGRICULTURAL MACHINERY (712)	.131313	.136536	.143913
OFFICE MACHINERY (714)	.140672	.145897	.153658
TYPEWRITERS (714.1)	.141047	.146088	.153827
OFFICE MACHINES,NES (714.9)	.121771	.128881	.133775
METAL WORKING MACHINERY (715)	.210315	.207921	.204483
MACHINE TOOLS (715.1)	.212535	.210061	.206434
TEXTILE MACHINERY (717.1)	.213600	.211055	.207374
SKIN,LEATHER WORKING MACHINERY (717.2)	.156015	.162711	.171137

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1985 TO 1990

	LOW	MED	HIGH
SEWING MACHINERY (717.3)	.143637	.148952	.156947
SPECIAL INDUSTRIAL MACHINERY (718)	.210494	.208403	.204655
PAPER AND PULP MACHINERY (718.1)	.154491	.159734	.167511
PRINTING MACHINERY (718.2)	.208069	.205556	.202209
FOOD PROCESSING MACHINERY (718.3)	.204654	.202753	.199936
CONSTRUCTION,MINING MACHINERY (718.4)	.142250	.147462	.155203
MINERAL AND GLASS WORKING MACHINERY (718.5)	.207394	.205224	.202342
OTHER SPECIAL MACHINERY (719)	.212798	.210582	.206796
HEATING,COOLING EQUIPMENT (719.1)	.212146	.209968	.206237
PUMPS AND CENTRIFUGES (719.2)	.211633	.209508	.205621
MECHANICAL HANDLING EQUIPMENT (719.3)	.214062	.211817	.207936
POWERED-TOOLS,OTHER (719.5)	.128437	.133128	.134086
SPRAYING,VENDING, OTHER MACHINERY (719.6)	.159280	.164029	.164841
BALL,ROLLER BEARINGS (719.7)	.139164	.144158	.151486
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	.207426	.205533	.202013
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	.216524	.214122	.210254
TOTAL ELECTRICAL MACHINERY (72)	.139401	.144600	.152269

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1985 TO 1990	LOW	MED	HIGH
ELECTRICAL POWER MACHINERY (722)	.143636	.148793	.156567
POWER TRANSFORMING MACHINERY (722.1)	.141486	.146669	.154388
SWITCH GEAR, ETC. (722.2)	.145362	.150516	.159254
EQUIPMENT FOR DISTRIBUTING ELECTRICITY (723)	.141495	.146667	.154406
INSULATED WIRE AND CABLE (723.1)	.140562	.145673	.153351
ELECTRIC INSULATED EQUIPMENT (723.2)	.155619	.160815	.169613
ELECTRICAL MACHINERY OTHER (729)	.139959	.145165	.152854
BATTERIES AND ACCUMULATORS (729.1)	.136773	.141972	.149574
ELECTRIC LAMPS (729.2)	.147954	.152596	.160543
VALVES, TUBES, ETC. (729.3)	.156005	.160793	.169203
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	.156961	.161781	.162496
MEASURING APPARATUS (729.5)	.225333	.221921	.217873
ELECTRO-MECHANICAL HAND TOOLS (729.6)	.218523	.215381	.211862
OTHER, NES (729.9)	.162670	.167329	.169341
TOTAL TRANSPORT EQUIPMENT (73)	.160668	.165150	.166190
RAILWAY VEHICLES (731)	.162308	.166817	.167827
LOCOMOTIVES, OTHER (731.3)	.164153	.168889	.169963

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1985 TO 1990

	LOW	MED	HIGH
PASSENGERS: RAILWAY, TRAMWAY CARS (731.5)	.161715	.166750	.167660
RAILWAY,LOCOMOTIVE CAR PARTS, NES (731.7)	.110322	.116464	.116464
BUSES (732.2)	.096508	.099977	.101387
LORRIES AND TRUCKS (732.3)	.164579	.169058	.170103
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	.140374	.145894	.153521
TRACTORS FOR TR-TRAILERS (732.5)	-.057532	-.055137	-.052059
SHIPS AND BOATS (735)	.160474	.165066	.166078
SHIPS AND BOATS NON-WAR (735.3)	.162172	.166873	.168137
SHIPS AND BOATS NES (735.9)	.144542	.148859	.149974

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1990 TO 2000

	LOW	MED	HIGH
TOTAL ENGINEERING PRODUCTS (7)	.222283	.226823	.225404
TOTAL MACHINERY NON-ELECTRIC (71)	.222340	.226875	.225457
POWER GENERATING MACHINERY (711)	.221931	.226471	.225074
BOILER,STEAM GENERATING MACHINERY (711.1)	.162613	.165951	.163540
STEAM ENGINES (711.3)	.221961	.226404	.224715
AIR CRAFT ENGINES (711.4)	.161451	.164830	.162480
OTHER INTERNAL COMBUSTION ENGINES (711.5)	.163555	.166846	.164401
NUCLEAR REACTORS (711.7)	.154757	.159621	.160406
ENGINES,NES (711.8)	.224722	.229092	.227386
AGRICULTURAL MACHINERY (712)	.158003	.161483	.159276
OFFICE MACHINERY (714)	.160508	.163958	.161623
TYPEWRITERS (714.1)	.160541	.164157	.161738
OFFICE MACHINES,NES (714.9)	.155734	.159478	.157508
METAL WORKING MACHINERY (715)	.222305	.226730	.225126
MACHINE TOOLS (715.1)	.222683	.227104	.225475
TEXTILE MACHINERY (717.1)	.222855	.227288	.225667
SKIN,LEATHER WORKING MACHINERY (717.2)	.164310	.167702	.165475

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1990 TO 2000

	LOW	MED	HIGH
SEWING MACHINERY (717.3)	.161318	.164669	.162349
SPECIAL INDUSTRIAL MACHINERY (718)	.222279	.226806	.225365
PAPER AND PULP MACHINERY (718.1)	.163935	.167227	.164728
PRINTING MACHINERY (718.2)	.221859	.226340	.224710
FOOD PROCESSING MACHINERY (718.3)	.221261	.225739	.224275
CONSTRUCTION,MINING MACHINERY (718.4)	.160951	.164340	.162003
MINERAL AND GLASS WORKING MACHINERY (718.5)	.221785	.226238	.224731
OTHER SPECIAL MACHINERY (719)	.222668	.227204	.225782
HEATING,COOLING EQUIPMENT (719.1)	.222558	.227099	.225695
PUMPS AND CENTRIFUGES (719.2)	.222475	.227009	.225556
MECHANICAL HANDLING EQUIPMENT (719.3)	.222885	.227414	.225977
POWERED-TOOLS,OTHER (719.5)	.147890	.153045	.153883
SPRAYING,VENDING, OTHER MACHINERY (719.6)	.154749	.159847	.160532
BALL,ROLLER BEARINGS (719.7)	.160161	.163465	.161151
MACHINERY AND MECHANICAL APPLIANCES,NES (719.8)	.221713	.226287	.224935
PARTS AND ACCESSORIES OF MACHINERY,NES (719.9)	.223306	.227829	.226391
TOTAL ELECTRICAL MACHINERY (72)	.160200	.163606	.161317

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDCNESIA

1990 TO 2000	LOW	MED	HIGH
ELECTRICAL POWER MACHINERY (722)	.161293	.164668	.162321
POWER TRANSFORMING MACHINERY (722.1)	.160739	.164125	.161804
SWITCH GEAR, ETC. (722.2)	.161707	.165095	.162714
EQUIPMENT FOR DISTRIBUTING ELECTRICITY (723)	.160741	.164143	.161817
INSULATED WIRE AND CABLE (723.1)	.160503	.163885	.161591
ELECTRIC INSULATED EQUIPMENT (723.2)	.164265	.167456	.165001
ELECTRICAL MACHINERY OTHER (729)	.160345	.163747	.161448
BATTERIES AND ACCUMULATORS (729.1)	.159529	.162929	.160655
ELECTRIC LAMPS (729.2)	.162266	.165636	.163254
VALVES,TUBES. ETC. (729.3)	.164170	.167506	.164990
AUTOMOTIVE ELECTRICAL EQUIPMENT (729.4)	.154087	.159219	.159751
MEASURING APPARATUS (729.5)	.224780	.229169	.227430
ELECTRO-MECHANICAL HAND TOOLS (729.6)	.223762	.228130	.226551
OTHER,NES (729.9)	.155433	.160541	.161199
TOTAL TRANSPORT EQUIPMENT (73)	.155082	.160202	.160853
RAILWAY VEHICLES (731)	.155601	.160728	.161387
LOCOMOTIVES, OTHER (731.3)	.155709	.160848	.161546

Appendix 9.20

TABLE: GROWTH RATES CALCULATED FROM THE FORECAST OF THE APPARENT DEMAND FOR CAPITAL GOODS FOR INDONESIA

1990 TO 2000	LOW	MED	HIGH
PASSENGERS: RAILWAY, TRAMWAY CARS (731.5)	.156487	.161580	.162419
RAILWAY.LOCOMOTIVE CAR PARTS, NES (731.7)	.141403	.146311	.147681
BUSES (732.2)	.136786	.142137	.142821
LORRIES AND TRUCKS (732.3)	.155914	.161024	.161662
SPECIAL PURPOSE LORRIES, TRUCKS AND VANS (732.4)	.160580	.163939	.161605
TRACTORS FOR TR-TRAILERS (732.5)	-.092390	-.078271	-.064000
SHIPS AND BOATS (735)	.155152	.160266	.160938
SHIPS AND BOATS NON-WAR (735.3)	.155710	.160795	.161409
SHIPS AND BOATS NES (735.9)	.150617	.155774	.156368

SOURCE: ECONOMETRIC RESEARCH LTD.

Part Threee: Capital Goods Production in Developing Countries: International Experience

Part Three. Capital Goods Production in Developing Countries: International Experience

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Part Three. Capital Goods Production in Developing Countries: International Experience

This Part begins with an overview of international trends in trade, production and consumption of capital goods. It then focuses more specifically on Latin American experience and on two particularly interesting cases: the role of multinationals in Brazil and of technological innovation in the Republic of Korea. The third chapter of examines a range of problems that have been encountered by developing countries at the micro level.

Chapter I. Experience at the macro level

1.1 International trends in capital goods

1.1.1 International trade

Annex Table 1 presents a summary picture of world trade in engineering products in 1978. Not surprisingly, the developed market economies dominate the scene, accounting for 88 per cent of exports and 60 per cent of imports. The USSR and other developed socialist countries account for another 10 per cent of more or less balanced trade. The developing countries are overwhelmingly net importers, with 30 per cent of imports but only 2.6 per cent of exports.

Annex Table 2 shows that, between 1970 and 1978, the developing countries raised their share in world trade in engineering products only marginally, but in absolute terms their exports of engineering products increased almost tenfold, to US $9.4 billion. As in the case of the developed countries, a relatively small number of developing countries account for the bulk of export trade in engineering products. As Annex Table 3 shows, only six developing countries recorded exports of machinery and transport equipment in excess of $500 million in 1979: Singapore, the Republic of Korea, Hong Kong (1978), Brazil, Yugoslavia and Argentina (1978). More than one-half of the exports of the three leading exporting countries fell into class 71 (electrical machinery) and consisted chiefly of electronic components and products, although the Republic of Korea has been developing rapidly as an exporter of other machinery. More than 50 per cent of their exports went to the developed market economies. Brazil and Argentina have become significant exporters of non-electrical machinery and transport equipment, in Brazil's case at a level comparable to those of several OECD countries.

1.1.2 Production and consumption

In addition to the trade statistics to which reference has been made, Annex Table 3 provides data on value added, number of employees, gross output and the domestic procurement ratio in the production of machinery and transport equipment for the 46 developing countries which collectively account for virtually the whole output of capital goods in the Third World. Seven countries, those in Group I, account for almost 90 per cent of total gross output. They meet approximately 60 per cent of their requirements from domestic production and have substantial, though widely varying, export ratios. Group II includes traditional (e.g. Argentina, Colombia, Chile, Egypt) as well as new capital goods producing countries with domestic procurements ratios in excess of 40 per cent or (as in the cases of Hong Kong and Argentina) substantial export ratios. Among them are two ASEAN countries, the Philippines and Thailand (no figures for Thailand). Indonesia, with all the rest, is classified in Group III, mostly with domestic procurement ratios of less than 25 per cent and little if any export of engineering products.

Annex Table 4 provides more detailed data on the capital goods industries of selected developing countries. Tanzania represents the large number of developing countries with virtually no capital goods sector and limited prospects, as indicated by very small imports (and presumably domestic consumption) of capital goods and shortage of skilled labour. Thailand and Peru appear as newly emerging capital goods producers, each with over 1,000 establishments and a significant core of scientifically or technically trained personnel. By far the largest domestic producers of capital goods among developing countries in terms of number of establishments and employees are the People's Republic of China and India, but Brazil surpasses India in value of gross output, apparent consumption and exports (no trade figures for the Peoples Republic of China are available). In Brazil, capital goods already account for 29 per cent of exports of manufactures, as compared with only 19 per cent in the Republic of Korea. Brazil had the advantage of a long prior period of engineering industry development for the domestic market, but the Republic of Korea has been rapidly catching up from a starting point of export-oriented industrial development concentrated initially on consumer goods.

Annex Table 5 provides data on growth of engineering value added in Asian countries. It confirms the predominance of India but also brings out the remarkable ascendance of the Republic of Korea and Singapore, with annual growth rates even during the second half of the 1970s of over 25 per cent.

1.2 Latin American Experience

In the years after World War II, much of Latin American embarked on a deliberate policy of industrialization based on import substitution, in the belief that manufacturing industry could serve as the dynamic engine of growth, creating employment for rural surplus labour, absorbing modern technology, reducing dependence on world markets for primary products and on imports of manufactures and thus overcoming chronic balance of payments problems. By the end of the 1950s, the most influential exponent of this strategy, Dr. Raul Prebisch, had come to the conclusion that the strategy was largely failing to achieve the hoped-for objectives. Import dependence was not being reduced, unemployment was not being significantly alleviated, balance of payments problems remained. He concluded that Latin American countries had to seek export markets for manufactures. His first approach was to recommend schemes of regional integration, to expand the horizons of manufacturers from domestic to regional markets, but none of these schemes (LAFTA, CACM, Andean Group) proved very successful. In his proposals for UNCTAD I he emphasised the need for developing countries to look to the large and growing markets of the advanced industrial countries and urged the latter to assist through preferential trading schemes. Some Latin American countries, especially Brazil, have followed this strategy with considerable success. The majority have continued to rely in their industrial development primarily on production for the domestic markets. Both the less and the more export-oriented Latin American countries, however, in contrast to the east Asian NICs, have from the beginning put considerable emphasis on engineering industries and domestic production of capital goods.

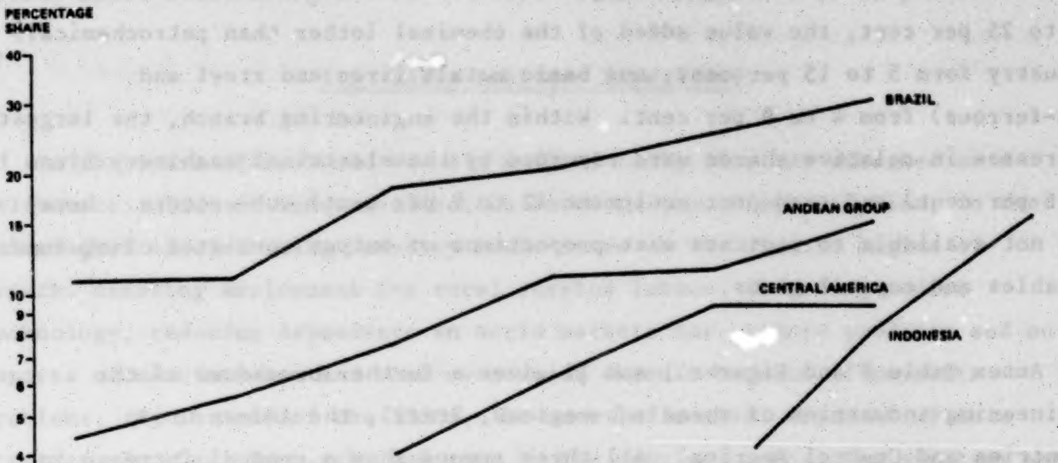
Along with sustained, though not very rapid, growth of total industrial production (annex table 6), averaging 6.3 per cent a year over the period 1960 to 1980, there have been considerable changes in the structure of manufacturing industries in Latin American countries. Annex Table 7 shows that, while in 1950, production of non-durable consumer goods accounted for almost two-thirds of industrial value added (food and beverages alone accounting for one-third), by 1977 their share had fallen to little more than one-third. The share of engineering industry (ISIC branch 38) had risen from 11 to 25 per cent, the value added of the chemical (other than petrochemical) industry form 5 to 15 per cent, and basic metals (iron and steel and non-ferrous) from 4 to 9 per cent. Within the engineering branch, the largest increases in relative shares were recorded by the electrical machinery (from 1 to 6 per cent) and transport equipment (2 to 8 per cent) sub-sectors. Data are not available to indicate what proportions of output consisted of consumer durables and capital goods.

Annex Table 8 and Figures I and II gives a further breakdown of the engineering industries of three sub-regions, Brazil, the Andean Group countries and Central America. All three groups show a gradual increase in the relative importance of engineering industry, with Brazil most and Central America least advanced. Whereas in Brazil the share of the engineering industry had already passed 15 per cent by 1960, it did not reach this figure in the Andean Group until 1977; similarly, the share in the Andean Group had passed 10 per cent by 1965, a figure not yet reached in Central America in 1975. Among sub-sectors, tranport equipment moved ahead of others in Brazil in the 1970s, followed by non-electrical machinery (the sub-sector containing most capital goods). In the other two sub-regions, fabricated metal products still recorded the largest share in 1977.

These figures reflect the fact that Brazil's dynamic growth in engineering industry has relied heavily on development of its automotive sub-sector. The Andean Group have also sought to develop automotive production beyond mere assembly of passenger cars but as yet with indifferent success. The prospects for any such development in Central American are meagre, since the minimum scale of production is far larger than the small domestic market and realistic export prospects combined.

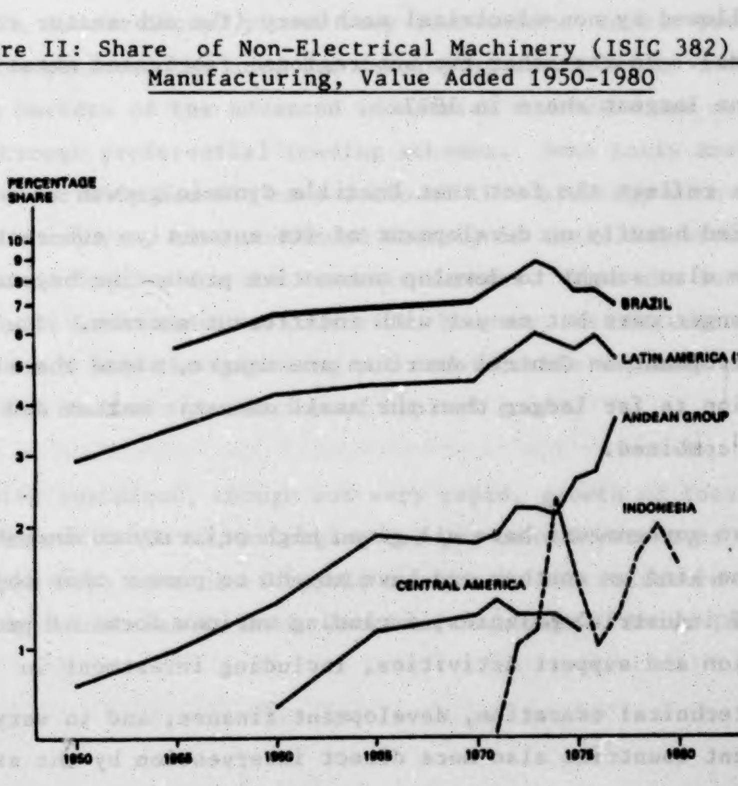
Latin American governments have all given high priority to industrial development of one kind or another and have sought to pursue this objective with a variety of industrial policies, including various forms of promotion such as, protection and support activities, including investment in infrastructure, technical education, development finance, and in varying degree in different countries also more direct intervention by the state

Figure I: Share of Engineering Industry (ISIC 38) in Total Manufacturing, Value Added, 1950-1960



Source: UNIDO (based on Annex Table 8).

Figure II: Share of Non-Electrical Machinery (ISIC 382) in Total Manufacturing, Value Added 1950-1980



Source: UNIDO (based on Annex Table 8).

acting as entrepreneur or as buyer of industrial products. Direct state ownership has been important in steel production (accounting for 60-100 per cent in Argentina, Mexico, Brazil, Chile, Venezuela and Peru) and in petroleum refining and petrochemicals in most of these countries. But governments have generally refrained from competing with the private sector in most other branches of manufacturing, except in instances where governments have taken over weak companies to maintain employment. The role of foreign investment by multinationals has been contentious, but most countries have seen the need for their participation in industrial development requiring high technology, large investments and efficient management.

Because of the importance of the role of multinationals and technological innovation in engineering development, it is instructive to look at two case studies, the first from Latin America, the second from east Asia.

Chapter II. Two case studies

2.1 The role of multinationals: Brazil

Transnational companies in Brazil have a production share of 46 per cent in the capital goods sector and 56 per cent in durable consumer goods. Both figures are far higher than for the other two major branches of engineering industry, production of intermediate products (35 per cent) and non-durable consumer goods (16 per cent). The difference is largely explained by the advantage which multinationals enjoy in advanced technology and access to export markets. Both of these are of greater importance in automotive and electrical machinery production than in other branches of manufacturing (if allowance is made for the major role of state enterprise in steel and petrochemical production).

Annex table 9 shows that capital goods production accounted for 41 per cent of investment by multinationas but for only 35 per cent of the number of multinational enterprises, indicating the relatively large investment per company in capital goods production. Again, this applies particularly to the transport equipment sub-sector, and to a less extent to electrical and telecommunications equipment production. In both sub-sectors, the 10 largest companies account for 60-80 per cent of multinational turnover, compared with less than one-half in the mechanical equipment sector which shows a significantly smaller average investment per enterprise. The relatively large number of enterprises in this sub-sector reflects in part the wide and diversified range of products.

2.2 Technological innovation: Republic of Korea

Korean production of capital goods began in 1960 with legislation to establish shipbuilding, motor vehicle, general machinery and electronics industries. During the 1970s further policies were adopted to expand machinery production, including a scheme to promote the heavy electrical machinery sector, a plan to develop machine tool and textile and agricultural machinery industry, the selection of 85 key kinds of machinery and of 35 types of specialized machinery for early development, the designation of 72 small machinery makers and a second long-term plan for the machinery sector. These measures were in most cases accompanied by low-interest finance and tax concessions. An Institute for Machinery and Metals, was established to upgrade the technical capability of Korean machinery industries.

Between 1960 and 1975 the share of the machinery industry in total manufacturing output doubled, with an average annual growth rate of 21 per cent, as compared with 13 per cent for manufacturing as a whole. This growth performance is attributable in large degree to the incentives provided by government to create a technology base for the machinery industry. In 1979 the Korean Government took further steps to facilitate the development of industrial technology in the capital goods industry. Capital goods developed by 70 enterprises were designated as "Newly Developed Innovative Machines" (NDIM) and special incentives offered for their production and purchase. The criteria used in designating NDIMs included:

1. the NDIM must have been developed with local patents or with a new technology;

2. local components content must be at least 60 per cent;

3. the NDIM must have been developed in the Republic of Korea without technical co-operation from abroad;

4. the quality must be certified by an independent quality inspection laboratory;

5. the NDIM must not be an exact copy of a foreign product;

6. no foreign components must be used for critical functions.

In other words, the objective was to promote local technological innovation in the capital goods industry.

A sample study of innovative entrepreneurs under the scheme showed that 85 per cent of them consisted of small- and medium-sized companies. This finding corresponds with similar findings in other industrializing countries suggesting that small companies tend to respond more flexibly to opportunities for innovation. Approximately two-thirds of the technological innovations arose in response to market needs and only one-third from more technical feasibility. In more than half the cases, the innovative company had outside technical assistance, either from research institutions or from potential users of the product. In most cases, catalogues and technical descriptions compiled by foreign machine producers were drawn upon for guidance.

The Korean case study underlines the importance of government incentives, market demand and technically competent and innovative entrepreneurs as necessary ingredients in the environment needed for the development of an indigenous technological capability in specific areas.

Chapter III. Experiences at the Micro Level

3.1 Introduction

This chapter draws on the experience of selected newly industrialising countries or areas (NICs) in producing capital goods and examining the problems experienced in association with such production. Capital goods are defined here to comprise industrial and agricultural machinery but excluding vehicles and electrical equipment. The selected group of NICs includes: Argentina, Brazil, India, the Republic of Korea, Mexico, Pakistan and the Province of Taiwan. Although the evidence is still far from systematic or conclusive, many of the issues raised are important.

Developing countries embark on the production of capital goods for a variety of reasons but four among them seem to assume special importance: the comparative advantage accruing from low costs of skilled labour; the capacity to produce machines embodying specifications and designs appropriate to their countries' factor proportions; the prospect of externalities (spin-off) from the capital goods sector to increase the efficiency of the entire manufacturing sector and economy; and to ensure a steady and realiable supply of this critically needed factor of production.

Indonesia's policy-makers have embarked on a strategy to adjust the manufacturing sector's structure of production by undertaking to produce the capital goods requirements of processing industries. To survive, the programme to produce capital goods domestically must be cost efficient. Thus, the considerations of cost efficiency are discussed first.

3.2 Cost Considerations

To describe and analyse the costs of production in the capital goods producing sector, we draw on the recent experience of the principal producers among developing countries: Argentina, Brazil, India, the Republic of Korea, Mexico, Pakistan and the Province of Taiwan. We consider both the producers of equipment and their suppliers in the metal products sector, particularly foundries and forges. Iron and steel operations are excluded, although costs of these products can drastically influence the cost of capital goods.

The typical experience of capital producers in developing countries suggests that the correct use of skilled labour can be as important in reducing costs as the optimal use of equipment. Thus, the competitiveness of developing countries in capital goods production is contingent on maintaining high productivity on individual tasks; alternatively, factor prices or material costs must be sufficiently low to offset firmwide productivity differences. These considerations will be addressed in terms of: the productivity of workers on tasks; the productivity of whole plants; the sub-contracting network; the record of some supplying sectors, and policies of government.

3.2.1 Task-Level Productivity.

Although skilled operatives in developing countries receive lower wages than those in developed countries, the obvious question is whether labour productivity is proportionately lower, allowing for the smaller quantity of capital per worker, and thus nullifies the wage differentials. Two aspects of labour productivity need to be distinguished. The first is the number of items produced per minute by a worker on a set task, assuming all complementary inputs are available, machines in good order, and so on. The second is output per operating day, which depends on the first aspect and also on the rate at which complementary inputs are made available, the frequency of mechanical failures not attributable to the operative, the time the operatives spend moving materials among work stations, the number of different tasks assigned to each worker, their respective set-up times, and so on.

Most observations of factories operating in NICs indicate that the performance of operatives on tasks is rather high, despite the use of less sophisticated machinery. In many activities their performance equals that of factory workers in developed countries, and it is rarely less than 30 per cent of their level.[1] Productivity on a plantwide basis, however, is often much lower. In India, for example, labour productivity in the textile-machinery sector was estimated at a third of that in European countries in the best firms and, at a tenth in the worst. Similarly, a study in the Republic of Korea of the entire mechanical engineering sector found labour productivity to be 20 to 30 per cent of that in Britain and the United States, whereas wages were less than 10 per cent of those in Britain and the United States.

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[1] Among the studies relevant to this issue are that on machinery industries in the Republic of Korea (World Bank, 1978), and those for foundries (World Bank, 1974), and textile machinery (World Bank, 1975) in India.

Lower productivity at the task level in the NICs, when it was observed, was attributed to a number of causes: inadequate instruction about the potential effectiveness of a machine tool; poor working conditions such as clogged floor space on which to begin a job; the use of poor quality tools; the absence of technical aids to operatives; and the failure to use jigs and fixtures in setting-up operations.[1/]

Indonesian planners need to distinguish here between those aspects which reflect a movement along a production function in response to a low wage-rental ratio (the use of poor quality cutting tools and the absence of jigs) and those that result in a failure to reach the production function due to X-efficiency (e.g. misestimation of a machine's potential). This distinction is not easy, but it is quite relevant, for the first group probably reduces production cost, whereas the second group increases them.

Although the quotation below is taken from a study about the Republic of Korea, similar examples are found in descriptions of other countries.[1/]

> In the best-run Western machinery and metal working establishments, there is an abundance of technical material available to the machine operator and the first-line supervisors. These materials take the form of wall charts, tabular materials, condensed handbooks of technical information, etc., all of which are designed to assist the man in making proper measurements, making conversions from one type of system to another (e.g., English measures into metric), to choose the right feed and speed for the machine based on the type of material being worked and the type of operation, and a variety of other technical information to assist in day-to-day standard operations in the plant. This kind of material was noticeably lacking in the plants visited. There is, of course, a good deal of documentation available to the front office management, the plant engineer, the production manager, etc., on the characteristics, design, functions, speeds and feeds for the specific machines in the shop, but that kind of information is at a different level from the kind being described here, which is standardised technical information that is necessary on the shop floor so that the operators and first-line supervisors will not have to do standard calculations, nor make guesses than can lead to mistakes when there is a simple way to look it up.

[1/] See Machinery Industries in the Republic of Korea (World Bank, 1978, Chapter 3).

3.2.2 Plantwide Productivity.

Plant layout and scheduling have significant impacts on productivity. Since in many machine-producing activities neither the order nor the placement of machines is inherent in the process, difficulties are raised by this wide latitude of choice, particularly for the NICs machinery industries. The typical plant in Mexico, Brazil or India exhibits a poor layout in which the movement of the work in process interferes with operations at the different work stations, so that an accumulation of partly finished pieces is held until workers return to them. Poor scheduling is also noted. In a study of forging in India[1/] it was observed that such poor scheduling had resulted in reduced use of labour and equipment, in delays in identifying and correcting errors and in high interest charges on carrying substantial semi-finished inventories.

A general characteristic of production of machinery in most of the NICs is low capacity utilisation. Mechanical engineering plants usually employ a number of costly individual items, such as machine tools, fixtures, and welding equipment. Each can be fully utilised if a plant produces a large batch of items of a single type or a range of products that require a similar operation such as stamping. At low volumes of output low utilisation rates are unavoidable. This problem will become (and has already become) less severe with growth of the domestic market and, as efficiency and marketing ability increase, with the growth of exports.

Materials management is a related area to be monitored. In Indian foundries it was often found that scraps and castings were not returned to their proper place for storage and that sand accumulating on the floor was removed only when little working space was left. The same phenomenon was observed in the Republic of Korea, Egypt, Mexico and Brazil. In an example from the Republic of Korea the World Bank reports "...as much as 50 per cent of the total floor area (was) occupied with heaps of discarded sand which had been knocked away from pervious castings."[2/]

Here is another description of the effects of poor scheduling on labour productivity:[3/]

> The common pattern was one of machine placement that is haphazard rather than allowing for an orderly flow of work. Floor space is very crowded and the operation

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[1/] Steel Forging in India, World Bank, 1974.
[2/] Machinery Industries in the Republic of Korea, World Bank, 1978, (p. 67).
[3/] Machinery Industries in the Republic of Korea, World Bank, 1978.

> of machining, fabrication of components, assembly of parts are scattered in any place that happens to have available room. Too much time is spent finding work, or the next job, or material. In some cases the men have to find their own area in which to work, perhaps make up some form of fixtures of their own, or find the means to obtain levels or measurements to work from. The almost universal characteristic is one of congestion and a mixing of operations that frequently leads to deterioration of quality because of improper floor planning. There is no adequate provision for working space around the main machines and the aisleways that are normally used to carry the flow of work are completely congested with work-in-process. There are typically about double the number of machines per square unit of floor space than there would be in an efficient layout. This is exacerbated by another condition, namely, wherever there is some vacant space because of temporary slowing down of poor operating practices, the tendency is for any small operations to settle in as "squatters" doing assembly of small components, or a welding and/or cutting operation.

3.2.3 Sub-contracting network.

In the machinery producing sectors of the advanced industrialised countries, sub-contracting has proved to be important in reducing costs. Small firms concentrating on a few operations or components common to a large number of producers are able to utilise special purpose equipment fully, as well as obtain the benefits of learning over time as a result of specialisation in a narrow area. If the volume of output were sufficient, such specialisation could occur within large firms, but quantities currently produced in most NICs and those expected to be produced in Indonesia in the near future are too small to allow this.

Two preconditions must be satisfied to reap the potential benefits of sub-contracting. First, the mother firm must be able to coordinate multiple sources of supply so that production is not interrupted by the absence of components. Second, the sub-contractors must be efficient and reliable.

The evidence from NICs suggests that sub-contracting in these countries is limited. There is, to be sure, some sub-contracting in some countries (Mexico) and in some sectors, but it is the exception, not the rule. This is the result partly of unreliability of existing sub-contractors in meeting delivery dates and quality specifications and partly of relatively high costs.

The two conditions combined imply that sub-contracting is cost effective when the organisational costs of sub-contracting are less than the cost reductions to be derived from it, i.e., from better factor utilisation and learning by doing. A further implication is that improved sectoral division of labour is contingent upon the accumulation of adequate organisational ability.

Related to the weakness of sub-contracting networks is the absence of an ability to rebuild equipment. This ability increases productivity because the cost of rebuilding typically is low relative to the price of new machines. In many cases rebuilding does not involve going back to the original design, yet it often leads to the addition of newly available features. While in developed countries numerous firms specialise in rebuilding, there is none in the Republic of Korea, the Province of Taiwan, the Philippines, etc.

3.3 Backward Linkages

Production of machinery does not operate in a vacuum. It necessitates the prior existence of well developed casting and forging activities. The production of these inputs is intensive in skilled labour, and mechanisation is not economical, except at very high volumes. Two sets of questions arise here about the performance of most NICs in this production. First, there are narrow questions about intra-plant efficiency. Second, there are broad questions arising from the high costs of domestic production and import substitution policies.

To establish the relative labour intensity of foundry and forging operations in NICs, consider the typical fixed-capital/labour ratios in India and the developed countries: in India it is $3,500 per worker, in the developed countries it is $25,000. But despite the savings in fixed capital, the price of Indian forgings similar in quality to imported forgings is, on the average, 50 per cent above the c.i.f. price of comparable imports. Half this difference is attributable to factors external to the firm such as the high price and erratic supply of raw materials. The remainder is attributable to internal inefficiency and small production runs. It has been calculated that Indian foundries and forges could, at internationally competitive prices (mainly of iron and steel) and improved and achievable levels of internal efficiency, sell their products at about 90 per cent of the world price. This could certainly contribute to the efficiency of the machinery producing sector.

Similar difficulties are encountered in the Republic of Korea and Mexico. A typical finding in the Republic of Korea is that the forging blanks weigh two to two-and-a-half pounds per pound of the net weight of the forged part. The wastage of material is twice or more that occurring with good practice. One interesting possibility noted in the study of technical development in Argentina is that faster technical upgrading may occur if supplier industries initially sell to high-quality producers of consumer durables such as automobile manufacturers.[1/]

Indonesia faces a number of structural challenges in its quest to build its non-oil sectors. Among them are the re-structuring of the manufacturing sector by developing capital goods producing activities, balancing agriculture and industry by furthering the integration of the joint dependencies, and balancing the regional mix of economic activity. Structural considerations are not separable, however, from efficiency considerations as these two aspects reinforce one another. Through efficiency resources are saved and more can be accomplished from any given volume of investment. Through efficiency, moreover, it is possible to maintain structural achievements which otherwise may not be sustainable without intolerable burdens. On the other hand, efficiency is not meaningful independent of the chosen structures within which it operates. Efficiency is desirable only in relation to effecting desirable objectives. What is not worth doing at all is not worth doing well.

Indonesia can save herself enormous waste by securing high task productivity, through proper training, specialisation and standardisation of work, and high plant-wide productivity by ensuring a clean and clear working space, by using jigs and fixtures, by proper material handling, by using proper tools, by understanding the potential of the machines, by productive layout of machines, by the development of reliable and specialised sub-contracting networks, by minimising the cost of coordinating parent and sub-contracting relationships and by the development of a competent and cost-efficient input supply network that feeds efficiently and reliably into the using sectors producing machinery.

To learn from the experience of others presupposes the existence of the will to learn and the will to apply the new knowledge and this presupposes the

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1/ Mariluz Cortes, "Argentina: Technical Development and Technology Exports to other LDC's", World Bank, February 1978.

existence of an educated core of policy-makers with a clear vision of the future and a strong sense of determination to effect change and progress. Indonesia is fortunate in having such a core, but policies adopted under pressure have not always, in retrospect, proved sound. Here again, the experience of other NICs may be useful and helpful.

3.4 Government policies

Superimposed on the technical difficulties faced by an infant capital goods producing sector may be additional difficulties induced by a policy designed to foster that sector's development. For example, in the Republic of Korea, Mexico and India there has been an early emphasis on the encouragement of large-scale firms by using a variety of incentives, including low-interest loans, investment credits and tax concessions. The outcome has frequently been the purchase of equipment that is several-fold too large for the domestic market. This is different from the problem faced by medium-sized firms which may initially possess equipment that can be efficiently used with a doubling of demand. The larger machines, we are emphasising here, may not initially be used for more than one-tenth of their capacity. Production is then saddled with inordinately high fixed costs and often leads to a diversified production base which competes with the product lines of small and medium-size firms, thereby reducing these firms production runs and raising social costs of production for the economy. Although this phenomenon is not limited to the capital goods' producing sector, it is more significant than in the capital goods using industries, given the much larger range of products that can be manufactured with a given set of equipment and the larger setting costs for each run.

The emphasis on size often leads to laxity about quality. This is particularly evident in the case of machine tools, such as cutters and shapers of metal which are used in the production of all equipment. But if locally produced tools are not adequate for the high precision needed in much of the equipment-producing sector they may compromise the effectiveness and competitiveness of the latter sector.

In such circumstances government policy must address this problem at two levels. First, emphasis on quality should be paramount and second, some imports should be admitted. The effect of restrictions on imports in India is well documented in this quotation:[1/]

> With few exceptions, machine tools and equipment are 10-25 years old and in poor condition due to both difficulty of importing spare parts and bad maintenance. This is particularly so in the heavy machine tool sectors where little if any replacement has taken place. Single purpose, non-automatic light machine tools dominate throughout, with consequently variable operator workmanship. In the early 1950s, when most Indian firms commenced manufacture, machinery was of low speed simple construction and had remained virtually unchanged for the previous 50 years. For these models, and with abundant cheap labour, the original machine tools were adequate. In the early 1960s there was a revolution in textile machinery design leading to machines 3-4 times faster than 1950 models. Within a few years this sophistication in design had out-moded all existing machine tools, as tolerance became critical, and extensive investment in re-tooling became the order of the day in Europe and Japan. Indian textile machinery makers did not follow suit and today expect to manufacture modern products with obsolete machinery. This leads to lower quality. In a large number of cases rejection rates are reportedly so high that, unless defects are overlooked and faulty parts used, production would be halted. The sad state of machinery has a disastrous cascading effect. Varying tolerance and modest operational ability necessitates intensive inspection. Usually costly remedial action has to be taken to patch up machines. Most machines have to be erected in plant and far too much filing was undertaken to ensure that all the parts fit. The lack of standardisation is also a constant concern for textile mills since it is very difficult to find spare parts that fit their machinery.

1/ The Textile Machinery Industry in India (World Bank 1975), pp. 20-21.

3.5 Export Prospects of Machinery

Firms in the developed countries have found it increasingly difficult to produce simple standard universal machines at competitive prices and are, therefore, obliged to concentrate on the production of more sophisticated machines. This trend has opened up the possibility of developing countries penetrating international markets. In 1979, the developed market economies imported machines valued at $196 million from developing countries, a substantial increase over the $4.3 million in 1970. More promising perhaps is the trade in machinery among developing countries which has grown from $13 million in 1970 to $98 million in 1978.[1/]

There are regional characteristics that affect the pattern of machine exports from developing countries. For instance, the distance between suppliers and markets appears to be an important factor. For users in Europe, Africa and, to a less extent, West Asia, standard machines are available at relatively low costs in the neighbouring developed countries such as Spain, Yugoslavia and in Centrally Planned Economies. On the other hand, major suppliers to South and East Asian markets are India, The Republic of Korea, and Singapore. Canada and the United States have easy access to Latin American suppliers in Argentina, Brazil and Mexico.

Developed countries import primarily conventional lathes, drilling machines and grinding machines demand for all of which is price-elastic. For instance, Japan's imports of machines from developing countries accounted for only 8.5 per cent of the value of her machine imports, but for about half the number of machines imported. These figures suggest that machines imported from developing countries were much cheaper than those imported from other developed countries; the average unit price per machine supplied by firms in the developing countries was $2,480 as compared to $28,530 from those obtained from suppliers in other developed countries.[2/]

The foregoing evidence is particularly relevant for the machine tool industry but carries with it significant lessons for the capital goods sector at large. Indonesia's export chances are best in conventional, standardised and cheap machinery and should be directed primarily to the Asian rim and/or Middle East and North America.

[1/] UN, Statistical Office.

[2/] Ministry of Finance, Customs Statistics, Tokyo, Japan.

3.6 Design adaptation and indigenous research and development

Given that the wage-rental ratio, however distorted it may be, is considerably lower in the NICs producing equipment than in the developed countries and given a cost minimisation objective, locally produced machinery should be labour-intensive. The rather thin evidence on this matter from NICs, however, suggests otherwise. But, the production of vintages of equipment no longer produced by more advanced countries shows responses to domestic factor proportions.

There are two sets of evidence on which to draw. First, there are detailed studies of specific sectors in developing countries, such as the Indian textile-machinery industry. Because these are focused on machine production, considerable information is available about the character and significance of technical design changes of the final product as well as the production of older designs, usually under licence. Much of the evidence on this matter is drawn from the experience of large firms and as such is applicable only to this class of firms.

A second set of studies describes the design activities of NICs equipment producers as a by-product of other interests, including analysis of export performance, the choice of technique, and the efficiency of small-scale enterprises.

Large firms often produce under licence and behind protected tariff walls They consequently face weak incentives to obtain the cost advantage that more labour-intensive equipment would confer. Smaller producers of equipment are more likely to sell to firms facing more competitive factor and product markets and, as a result, to undertake greater adaptation of imported designs or to produce their own. Indonesia would be well advised not to overlook this evidence. As long as large firms continue to rely on licences, only smaller firms are expected to be interested in copying and adapting existing equipment. Indians and Koreans continue to produce semi-automatic looms which have proved more desirable in the local market, partly because of only sporadic availability of the high-quality yarn necessary to realize the fast speeds of modern looms and partly because of the lower initial cost of equipment and low wages in the textile sector.

Relying solely on equipment of older vintage, may end up giving the developed countries technological dominance. Design research is then a very crucial complement to considerations of efficiency elaborated above.

There are a number of instances of companies modifying imported designs, upgrading them, and producing a machine that permits a lower capital-labour ratio in the using sector. For example, Argentine companies are currently producing food-processing equipment that is less mechanised than advanced-country equipment designed for the same product. Other pieces of evidence indicate that smaller firms in many countries, usually not manufacturing under licence, have produced simple equipment that is often used for the production of goods whose quality is too low for international trade.

There is also ample evidence that developing countries in general do not devote much effort or resources to research, and that is true even in the NICs. Much of the limited research undertaken in developing countries is process related and pertains primarily to design. Research and development in developing countries suffer from a major comparative disadvantage within the prevailing structures. Structural and institutional changes are required to elevate this activity to the level needed to match the continuous breakthroughs in the advanced economies. In simple terms, Indonesian policy-makers must approach this area by treating technology development as an infant industry that requires necessary but temporary nurturing.

3.7 Conclusion

The long-term competitiveness of Indonesia's capital goods production will ultimately depend on three conditions: first, reducing excess production costs attributable to the types of inefficiencies cited earlier; second, undertaking research to reduce production costs and to alter designs; and third, expanding the domestic market and venturing into the world market.

Some of the excess production costs attributable to inefficiencies will decline of their own accord through greater experience and a growing level of output. Labour productivity on set tasks will improve with learning by doing. Plant-wide productivity should also grow as a consequence of an increase of individual plants and management training. In addition, augmented organisational experience should increase the ability of both the firm and the sector to gain from sub-contracting.

On the other hand, X-inefficient practices -- the absence of conversion guides for machine operators, the misuse of existing machinery and problems of layout -- are likely to require special attention, foreign consultants, visits to foreign firms and upgrading of both firm level and country-wide research organisations to enhance knowledge of the best practice.

STATISTICAL ANNEX

Annex Table 1

World Exports and Imports of Engineering Products, 1978

	Exports		Imports	
	10^6 US $	%	10^6 US $	%
Developed market economy countries	324,771	88.2	220,404	59.9
of which:				
West Germany	66,847	18.2	23,895	6.5
U.S.A.	60,156	16.3	44,871	12.2
Japan	55,511	15.1	4,518	1.2
France	27,822	7.6	19,319	5.3
U.K.	24,432	6.6	17,665	4.8
Italy	18,400	5.0	10,765	2.9
Canada	14,698	4.0	19,233	5.2
Developed planned economy countries	36,410	9.3	37,492	10.1
of which:				
U.S.S.R.	9,906	2.7	17,491	4.8
Czechoslovakia	5,603	1.5	3,557	1.0
Developing countries	9,385	2.6	110,326	30.0
World Total	370,565	100.0	370,565	100.0

Source: Bulletin of Statistics on World Trade Engineering Products, 1970 ECE, United Nations, New York, 1980.

Annex Table 2

Development of Trade in Engineering Products between Economic Regions, 1970 and 1978
(Millions of Current US $)

To	Development market economy countries		Developed planned economy countries		Developing countries		World	
From	1970	1978	1970	1978	1970	1978	1970	1978
Developed market economy countries	57,617.9	211,722.9	2,376.7	12,677.2	18,419.6	100,300.6	78,414.2	324,770.7
Developed planned economy countries	800.1	3,282.5	7,202.7	24,819.6	2,065.7	5,965.6	10,072.2	34,067.7
Developing countries	504.5	5,439.0	7.6	5.6	455.6	4,030.0	967.7	9,384.6
World	58,922.5	220,404.3	9,587.0	37,492.4	20,940.9	110,326.2	89,454.1	368,222.9

Source: Bulletin of Statistics on World Trade in Engineering Products, 1978, ECE United Nations, New York, 1980.

a/ Excludes exports of Romania not distributed by destination of 2,342.3.

Annex Table 3

Machinery and Transport Equipment: Production and Trade[a] in Selected Developing Countries

(1980 or latest year available)

Country or Territory	Year	(1) Value Added	(2) Number of Empl.	(3) Gross Output	(4) Imports	(5) Exports	(6) Apparent Consumption (3-5+4)	(7) Dom. Procurement Ratio (3-5)(6)	(8) Export Ratio (5):(3)
		$ Mill.	Thousands	$ Mill.	$ Mill.	$ Mill.	$ Mill.	Per Cent	Per Cent
GROUP I									
China[b]	1980	27,700	13,600	51,800	n.a.	n.a.	n.a.	n.a.	n.a.
Brazil	1979	7,200[c]	n.a.	16,900[c]	4,000	2,400	18,300	78	18
Yugoslavia	1979	6,802	673	19,162	5,238	2,100	22,300	77	11
Republic of Korea	1979	4,597	596	13,024	6,153	3,233	15,944	61	25
India	1977	2,308	1,244	8,638	1,234	375	9,495	87	4
Mexico	1977	n.a.[f]	100[f]	3,437[f]	2,530	248	5,719	56	7
	(1976)	(709)	(106)						
Singapore	1979	1,517	148	4,029	5,190	3,767	5,452	5	93
GROUP II									
Hong Kong	1978	1,313	231	4,041	3,590	2,590	5,093	30	63
Venezuela	1979	1,284	88	4,050	5,477	28	9,499	42	1
Uruguay	1977	154[g]	51[g]	348[g]	197	14	531	63	4
Kenya	1978	96	31	462	691	7	1,146	40	2
	(1979)	(137)	(30)						
Colombia	1977	589	80	1,381	763	63	2,081	63	5
Iran	1974	553[e]	66[e]	1,597[e]	2,072	33	3,636	43	2
	(1977)				(6,380)	(41)			
Argentina	1978	n.a.	70[f]	1,090[f]	1,476	510	2,056	28	47
Thailand[d]	1978	n.a.	n.a.	n.a.	1,637	137	-	-	-
	(1977)	(476)							
Chile	1977	433	44	723	700	27	1,395	50	4
Peru	1977	372	n.a.	845	595	27	1,413	58	3
	(1973)	(330)	(34)						
Egypt	1976	306	93	800	1,175	11	1,964	40	1.4
Philippines	1977	240	100	1,125	1,105	53	2,177	49	5
GROUP III									
Indonesia	1978	235	92	740	2,434	71	3,103	22	10
Cuba	1976	n.a.	n.a.	665	1,327	-	1,992	33	-
	(1979)		(91)						
Nigeria	1976	154	23	582	3,896	-	4,478	13	-
Ivory Coast	1978	127	7	415	902	35	1,282	30	8
Tunisia	1978	94	15	337	742	31	1,048	29	9
Iraq	1975	94[g]	20[g]	201	1,724	-	1,925	10	-
Zambia	1974	75	10	179	258	-	437	41	-
Bangladesh	1978	71	n.a.	147	245	3	389	37	2
	(1977)	(65)	(24)						
Ecuador	1976	69	10	148	441	5	584	25	4
Kuwait	1977	66	n.a.	108	2,205	275	2,030	-8[i]	255
	(1976)	(45)	(4.6)						
United Arab Emirates	1978	57	4.3	111	2,364	126	2,349	-1[i]	114
Malta	1978	52	5.3	94	93	48	139	33	51
Papua New Guinea	1976	48[e]	7[e]	111[e]	138	-	249	45	-
Cyprus	1979	38	4	85	236	28	293	19	33
Costa Rica	1978	n.a.	n.a.	175	363	30	508	29	17
	(1975)	(29)	(7)						
Nicaragua	1976	29[e][h]	2.4[e][h]	60[e][h]	236	2.8	294	20	5
Jordan	1978	28[h]	4.2[h]	81[h]	451	40	492	8	49
Dominican Republic	1978	28[h]	3	72	204	14	262	26	19
United Republic of Tanzania[d]	1974	n.a.	n.a.	55	179	-	234	24	-
	(1977)	(27)	(7)						
Panama	1977	19	1.8	39	166	4	201	17	10
Madagascar	1976	9.6	3	30.7	70.5	2.1	99	29	7
Mauritius	1976	9.1[h]	n.a.	21.3[h]	86.1	10.9	97	11	51
Fiji	1977	9.0	1.4	24.9	54.6	5.1	74.4	27	20
Barbados	1977	6	2	16	51	11	56	9	69
Ethiopia	1976	3.1	1.1	8.4	120	3.4	125	4	40
Afghanistan	1977	n.a.	2	5.4	35	-	40.4	13	-
Somalia	1976	0.2	0.1	0.9	44	1.6	43	-2[i]	186

Source: United Nations, Yearbook of International Trade Statistics, 1979 (United Nations publication, Sales No. E/F.80.XVII.5) vol.I., United Nations Yearbook of Industrial Statistics, 1978 Edition (United Nations publication, Sales No. E.80.XVII.9) and Ibid: 1979 Edition (United Nations publication, Sales No. E.81.XVII.8).

[a] Value added, gross output and employment refer to ISIC 38; imports and exports refer to SITC 7 (Rev.1).

[b] See table I.3 for the method used in Chinese statistics.

[c] Capital goods only (see table I.3 for explanation of data).

[d] For the United Republic of Tanzania and Thailand see table I.3.

[e] Including ISIC 390.

[f] Excluding ISIC 385.

[g] Including ISIC 372.

[h] Including ISIC 371 and 372.

[i] The ratio is negative owing to imports that are re-exported.

Annex Table 4

Indicators of the Development of the Capital Goods Sector in Selected Developing Countries
(1980 or latest available year)

	China, Peoples Rep. of	India	Brazil	Rep. of Korea
1. Number of establishment[a] engaged in capital goods manufacturing (thousands)	107.2	17.9	11.2	6.0
2. Number of workers engaged[b] in capital goods manufacturing (thousands)	13,600	1,230	838	417
3. Number of scientists and[c] engineers	n.a.	698	541	800
4. Number of engineering[d] graduates	n.a.	13,611	8,140	32,193
(per cent increase over 10 years earlier)	n.a.	14	148	539
5. Gross output[e] ($billion)	51.8	8.5	16.9	9.2
6. Imports[f] ($billion)	n.a.	1.2	4.0	6.1
7. Exports[g] ($billion)	n.a.	0.4	2.4	2.4
8. (7) : (5) (per cent)	n.a.	4.7	14.2	26.5
9. (7) as per cent of all manufactured exports (SITC 5 to 8-(67 + 68)	n.a.	15.0	29.0	19.0
10. Apparent consumption of capital goods ($billion) ((5)+(6)-(7))	n.a.	9.3	18.5	12.9
11. Domestic supply ratio ((5)-(7) as per cent of (10))	n.a.	87.1	78.4	52.0
12. Value added[h] ($billion)	15.5	2.2	7.2	3.3
13. Production of machine tools[i] ($million)	420	156	380	130
14. of which exports	28	27	46	25
15. Imports of machine tools[j] ($million)	60	48	8.9	360
16. Apparent consumption[k] of machine tools ($million) ((13)+(15)-(14))	452	177	423	465
17. Domestic supply ratio for machine tools ((13)-(14) as per cent of (16)	86	73	79	23

Annex Table 4
(continued)

Indicators of the Development of the Capital Goods Sector in Selected Developing Countries
(1980 or latest available year)

	Peru	Thailand	United Rep. of Tanzania
1. Number of establishment[a] engaged in capital goods manufactureing (thousands)	1.5	1	0.1
2. Number of workers engaged[b] in capital goods manufacturing (thousands)	51	n.a.	7
3. Number of scientists and[c] engineers	85	20	n.a.
4. Number of engineering[d] graduates	346	2,131	53
(per cent increase over 10 years earlier)	31	470	n.a.
5. Gross output[e] ($billion)	0.8	n.a.	n.a.
6. Imports[f] ($billion)	0.6.	1.6	0.4
7. Exports[g] ($billion)	0.03	0.1	n.a.
8. (7) : (5) (per cent)	3.0	n.a.	n.a.
9. (7) as per cent of all manufactured exports (SITC 5 to 8-(67 + 68)	25.0	16.2	n.a.
10. Apparent consumption of capital goods ($billion) ((5)+(6)-(7))	1.4.	n.a.	n.a.
11. Domestic supply ratio ((5)-(7) as per cent of (10))	58.0	n.a.	n.a.
12. Value added[h] ($billion)	0.4	0.77	0.027
13. Production of machine tools[i] ($million)	n.a.	n.a.	n.a.
14. of which exports	n.a.	n.a.	n.a.
15. Imports of machine tools[j] ($million)	64	95	18
16. Apparent consumption[k] of machine tools ($million) ((13)+(15)-(14))	n.a.	n.a.	n.a.
17. Domestic supply ratio for machine tools ((13)-(14) as per cent of (16)	n.a.	n.a.	n.a.

Note: The data are not strictly comparable owing to differences in coverage of years, number of establishments and goods produced and traded. The information for India and the Republic of Korea in this table differs from that shown elsewhere because consumer goods are excluded from production and trade data. For details see following notes and sources.

Notes and sources

a/ Brazil, Republic of Korea, Peru: establishments employing five or more workers; India: Establishments with 10 or more workers using electric power, or 20 or more workers not using power; China: all establishments (wholly people-owned and collectively-owned enterprises); Thailand: small shops with fewer than 10 employees are included in the estimate provided in a case study of Thailand (TD/B/C.6/AC.7/4 of UNCTAD); United Republic of Tanzania: estimate from a case study (TD.B/C.6/AC.7/5 of UNCTAD).

The information relates to 1980 (China), 1979 (Republic of Korea), 1977 (India, United Republic of Tanzania and Peru), 1974 (Brazil). Sources: United Nations Yearbook of Industrial Statistics, 1978 edition and 1979 edition, vol. I for Brazil, the country case studies for the other countries and Report on Mining and Manufacturing 1979. Economic Planning Board, Republic of Korea, 1981. Establishments making radio and TV sets (ISIC 3832) were excluded in India and Republic of Korea but not in the other countries.

b/ Same coverage as for a/. With respect to China, in the United Nations Yearbook of Industrial Statistics, 1979 edition, vol. 1, p.86, it is reported that the total number of employees in ISIC 382- the only subsector reported under ISIC 38- was 9,175,000 and includes only employees of wholly-owned enterprises with independent accounts. In the case of the United Republic of Tanzania the figure is an estimate based on the 1974 figure given in a UNCTAD case study of 5,300 and an estimated growth rate of 14 per cent per annum extended to 1977.

c/ The number of scientists and engineers in taken from Statistical Yearbook of UNESCO, 1981. Data are given for following years: 1977 (India and Republic of Korea), 1975 (Thailand), 1974 (Peru), 1970 (Brazil).

d/ The information relates to 1979 for the Republic of Korea, 1978 for Brazil, 1977 for Peru, and 1976 for India, United Republic of Tanzania. Source: Statistical Yearbook of UNESCO, 1972, 1975 and 1981 editions.

e/ Excluding electrical appliances and passenger cars in Brazil, India and Republic of Korea; ISIC 38 for Peru. For China, gross output is expressed in 1970 prices converted into US dollars at the 1970 rate of exchange.

The information relates to 1980 for China, 1979 for the Republic of Korea and Brazil, and 1977 for Peru and India.

f/ Imports are SITC 7, Rev. 1 for India, Peru, Thailand and United Republic of Tanzania, SITC 7 minus 781 (following SITC, Rev. 2) for the Republic of Korea. For Brazil data concerning capital goods imports were taken from the Brazilian case study (TD/B/C.7/AC.7/6). The informaion relates to 1980 for the United Republic of Tanzania, 1979 for Brazil and Repulic of Korea, 1979 for Thailand and 1977 for India and Peru.

g/ Exports are SITC 7, Rev. 1 for India, Peru and Thailand, SITC 7 minus (761+762+763+781), following SITC, Rev. 2 for the Republic of Korea. For Brazil, they were taken from the case study. The information relates to the same year as for imports (see note (b) above).

h/ Value added for India, Brazil and Republic of Korea refer to the same coverage as gross output; for China, value added was estimated to be 30 per cent of gross output. For Brazil, value added has been estimated on the basis of the share of value added in gross output of ISIC 382 to 385 and 390 in 1974 (as reported in the United Nations Yearbook of Industrial Statistics), applying it to the 1979 figure (reported in the Brazilian case study). For Thailand, the information was taken from the Thailand case study. For the United Republic of Tanzania, the figure was obtained by applying the ratio of ISIC 38 to GDP in 1974 to the GDP estimates for 1977, assuming that this ratio stays more or less constant. The information relates to 1980 for China, 1979 for Brazil, Thailand and Republic of Korea, and 1977 for India, United Republic of Tanzania and Peru.

i/ Estimates for 1980 as shown in National Machine Tool Builders' Association (McLean, Virginia, USA), Economic Handbook of the Machine Tool Industry 1981-1982, United States, 1981, page 165.

j/ 1980 for China, India, Republic of Korea and Brazil, as shown in National Machine Tool Builders' Association, "Economic Handbook ..." (op. cit.) page 165. For Peru, Thailand and United Republic of Tanzania the figures represent the accumulated imports in the period 1972-1977 (SITC 715.1 Rev.1). Imports of machine tools into Peru and Thailand in 1977 were only US $9 million and $24 million respectively; into the United Republic of Tanzania they were $14 million in 1975 and $2 million in 1976.

k/ Since in Peru, Thailand and the United Republic of Tanzania local production is very small or non-existent, the accumulated imports in the 1972-1977 period can give a rough idea of the recent stock. For the other countries the figures for apparent consumption relate to 1980.

Annex Table 5

Manufacturing value added (MVA) of ISIC-groups 382, 383 and 384 (machinery and transport equipment) 1970, 1975 and 1980

(in 1000 US $, at constant 1975 prices)

	1970	1975	1981	
Bangladesh	......	10,600	32,186	
India	1,844,181	2,187,300	3,149,934	
Indonesia	64,203	159,300	335,938	
Hong Kong	292,420	423,900	569,523	(1976)
Korea, Republic of	115,324	519,203	1,593,632	(1980)
Malaysia (Western part only)	119,274	190,100	335,947	(1980)
Pakistan	75,637	140,600	138,994	(1976)
Philippines	232,743	302,000	464,321	
Singapore	188,491	426,000	1,385,528	
Sri Lanka	27,078	28,700	....	
Thailand	88,384	196,900	....	

Source: UNIDO: Industrial Strategies and Policies in Developing South, Southeast and East Asia: A Review.UNIDO/IS.412, 15 November 1983.

Annex Table 6

Growth of Industrial Production in 15 Latin American Countries, 1960-80
(Average compound rates of growth)

	GDP %	Industry[a] %
Argentina	3.3	4.0
Bolivia	5.0	5.8
Brazil	7.4	7.8
Columbia	5.6	5.4
Costa Rica	5.8	8.0
Chile	3.7	3.5
Ecuador	6.4	9.0
El Salvador	4.4	5.4
Guatemala	5.5	7.1
Honduras	4.5	5.6
Mexico	5.8	7.8
Nicaragua	4.1	6.0
Paraguay	6.5	8.7
Peru	4.0	4.4
Venezuela	5.2	6.3
Unweighted average	5.1	6.3

Source: ECLA, based upon Official Statistics.

a/ Includes mining and construction.

Annex Table 7

Latin America (15 countries)[a]: Structure of the Manufacturing Industries, 1950-1977

(Percentages of Value Added)

ISIC	Industry	1950[b]	1955[b]	1960[c]	1965	1970	1975	1976[d]	1977[d/e]
311-312 313-314	Food, beverage and Tobacco	31.0	28.6	26.7	24.4	23.0	20.7	19.8	18.9
321	Textiles	15.9	14.7	11.9	10.2	8.8	8.2	7.9	7.8
322-324	Wearing apparel and footwear	8.1	7.1	5.5	4.5	3.6	3.5	3.2	3.0
323	Leather	1.0	0.9	0.7	0.6	0.8	0.4	0.4	0.3
332	Furniture	2.2	1.9	1.7	1.5	1.3	1.3	1.3	1.5
342	Printing and publishing	4.2	4.0	3.5	3.3	3.2	2.6	2.7	2.8
390	Other manufactures	1.0	0.9	0.9	0.9	1.1	0.9	0.9	0.9
	Subtotal Group A	63.4	58.1	50.9	45.5	41.8	37.6	36.2	35.1
331	Wood and cork products	2.9	2.4	2.3	2.1	1.8	1.7	1.8	2.1
341	Paper and paper products	2.2	2.4	2.1	2.5	2.6	2.3	2.4	2.4
351-352 356	Industrial chemicals, other chemicals and plastic products	5.4	7.3	8.8	10.0	11.3	12.6	13.5	14.7
353-354	Petroleum refineries and misc. products of petroleum and coal	4.8	5.6	6.0	6.6	6.3	5.6	5.8	4.3
355	Rubber products	1.5	1.8	1.8	1.9	2.0	2.2	2.3	2.3
361-362 369	Manufacture of non-metallic mineral products	5.3	5.6	4.9	4.6	5.1	5.4	5.4	6.1
371-372	Iron and steel and non-ferrous metals	3.6	4.6	5.7	7.0	7.3	7.6	7.4	8.5
	Subtotal Group B	25.7	29.7	31.7	34.6	36.4	37.4	38.6	40.4
381	Metal products	4.3	4.6	4.6	5.6	5.8	5.6	5.4	5.0
382	Non-electrical machinery	2.9	3.5	4.2	4.4	4.5	5.4	5.8	5.1
383	Electrical machinery	0.9	1.1	3.0	3.8	4.3	4.7	5.0	5.7
384	Transport equipment	2.4	2.6	5.1	5.5	6.7	8.7	8.3	7.9
385	Professional equipment	0.4	0.4	0.5	0.6	0.4	0.6	0.6	0.8
	Subtotal Group C	10.9	12.2	17.4	19.9	21.8	25.0	25.3	24.5
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: ECLA, based on official statistics.

[a] Argentina, Bolivia, Brazil, Colombia, Costa Rica, Chile, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Paraguay, Peru and Venezuela.

[b] Excluding Bolivia, Chile, Paraguay and member countries of the Central American Common Market (Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua).

[c] Excluding Paraguay.

[d] Excluding member countries of the Central American Common Market.

[e] Excluding Argentina.

Annex Table 8

Share of Metal Working Industry in the Manufacturing Industry in Latin America and Selected Sub-regions 1950-1977

(Percentages of Value Added)

ISIC	Product Group	1950	1955	1960	1965	1970	1971	1972	1973	1974	1975	1976	1977
Latin America													
381	Fabricated metal products	4.3	4.6	4.6	5.6	5.8	5.7	5.8	5.7	5.4	5.6	5.4	5.0
382	Non-electrical machinery	2.9	3.5	4.2	4.4	4.5	5.0	5.4	5.9	5.6	5.4	5.8	5.1
383	Electrical machinery	0.9	1.1	3.0	3.8	4.3	4.4	4.6	4.9	4.5	4.7	5.0	5.7
384	Transport machinery	2.4	2.6	5.1	5.5	6.7	7.2	7.5	8.2	8.9	8.7	8.3	7.9
385	Professional equipment	0.4	0.4	0.5	0.6	0.4	0.6	0.7	0.7	0.6	0.6	0.6	0.8
	Subtotal	10.9	12.2	17.4	19.9	21.8	23.0	24.0	25.4	25.0	25.0	25.2	24.5
Brazil													
381	Fabricated metal products	-	2.9	3.4	3.9	4.3	4.7	5.0	5.4	5.2	5.2	5.2	5.0
382	Machinery except electrical		5.5	6.4	6.8	7.0	7.6	8.1	8.8	8.4	7.4	7.5	6.9
383	Electrical machinery	10.9	1.2	3.2	4.3	5.3	5.7	6.0	6.5	5.4	5.6	5.9	5.9
384	Transport equipment		1.2	5.2	5.1	8.0	8.9	9.6	10.3	11.7	11.5	10.9	10.4
385	Professional equipment		0.2	0.4	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Subtotal Group C	10.9	11.1	18.6	20.6	25.2	27.6	29.4	31.7	31.3	30.5	30.2	28.9
Andean Group a/													
381	Fabricated metal products	1.2	1.6	2.8	3.5	3.7	3.8	3.8	3.8	3.6	4.4	4.1	4.8
382	Machinery except electrical	0.8	0.9	1.3	1.9	1.8	1.9	2.2	2.2	2.1	2.6	2.7	3.6
383	Electrical machinery	1.0	1.0	1.3	2.1	2.6	2.7	2.9	2.9	3.0	3.7	3.7	4.1
384	Transport equipment	1.4	2.0	2.0	3.3	3.0	3.1	3.3	3.5	3.2	3.9	3.6	2.8
385	Professional equipment		0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.4	0.2	0.3
	Subtotal	4.4	5.6	7.5	10.9	11.3	11.7	12.4	12.6	12.2	15.0	14.3	15.7
Central America b/													
381	Fabricated metal products			1.2	3.1	4.8	4.8	4.9	5.0	5.0	4.6		
382	Non-electrical machinery			0.7	1.1	1.2	1.3	1.2	1.2	1.2	1.1		
383	Electrical machinery			0.3	0.7	1.7	1.7	1.7	1.8	1.9	1.8		
384	Transport equipment			1.8	1.5	1.6	1.7	1.6	1.5	1.6	1.7		
	Subtotal			4.0	6.3	9.3	9.5	9.4	9.5	9.7	9.2		

Source: UNIDO: The Capital Goods Industry in Latin America: present situation and prospects (draft dated 15 November 1983 UNIDO/IS)

a/ Bolivia, Colombia, Ecuador, Peru and Venezuela.
b/ Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua.

Transnational Enterprises in the Capital Goods Sector in Brazil, 1977

	Transnational enterprises		Transnational investment		Major transnational enterprises		Investment per enterprise Million of US $
	Number	% of Total	Million of US $	%	Number	Share in sales of all TNG of same product group (%)	
Mechanical industry	106	16.4	825	8.1	10	48.1	7.8
Electrical equipment and telecommunications	71	11.0	1,639	16.0	10	59.6	23.1
Transport equipment	46	7.1	1,726	16.9	10	82.1	35.5
Total of above	223	34.5	4,190	41.0	30	63.3	18.8
Total of transnational enterprises in manufacturing industries	647	100.0	10,217	100.0	105	62.5	15.8

Source: UNIDO: The Capital Goods Industry in Latin America: present situation and prospects (draft dated 15 November 1983 UNIDO/IS).

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The Capital Goods Industry in Latin america: Present Situation and Prospects	Forthcoming
System on Food Proces Machinery and Technology for Developing Countries	Forthcoming

Part Four. Potential for Development of a Selected Capital Goods Industry

Part Four. Potential for Development of a Selected Capital Goods Industry

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Part Four. POTENTIAL FOR DEVELOPMENT OF A SELECTED CAPITAL GOODS INDUSTRY

Chapter I Introduction

The Government of Indonesia, within the context of planning further development of capital goods production during Repelita IV, has requested UNIDO to report specifically on the potential for domestic production of equipment for the following in industries:

1. Coconut and palm oil
2. Rubber
3. Sugar
4. Cocoa, coffee, tea
5. Wood
6. Cement
7. Textiles

UNIDO was asked to address the following questions: Which engineering industries within this group could be developed relatively easily and why? Which types of equipment could be produced domestically, how, where and by whom? Could examples of (say) 25 projects be given which would be promising candidates for promotion? What sub-sectoral, feasibility studies or other follow-up studies would be required? Part Four of this report takes up these questions.

It should be said at the outset that, for lack of data and time, only very tentative and partial answers can be given to these questions at this stage. On many relevant and indeed essential aspects, even of the present situation in Indonesia, the required statistical data have not been available or have proved inadequate.

This applies, for example, to aspects of current production of the products of the equipment using industries, such as sugar, textiles or wood processing. It also applies to the degree of capacity utilisation of existing plant in these industries, the effective reserve capacity and the technical and economic efficiency of the equipment in use. It applies equally to the sources of equipment at present in use, whether imported (e.g. from which countries or firms) or domestically produced (where and by whom). It applies even more to the information needed to make projections of future output, and hence capital requirements, of these industries. In general, Repelita IV target figures have been taken as the starting point where such figures have been available. The Repelita IV period 1984-89 has also been taken as the investment planning period. But it needs to be recognized that production of equipment in most cases is unlikely to become effective before Repelita V especially where prior investment in production capacity is needed.

Adequate assessment of the potential for future domestic production of equipment for these industries requires detailed knowledge of current technology and expert assessment of technological trends. Every effort has been made to draw on the experience and specialised expertise of international equipment supplying companies in developing countries to make the best possible judgements, but such matters are clearly subject to much uncertainty.

Finally, and most serious of all, hardly any of the economic data are available which are needed to assess whether domestic production of the many hundreds of items of equipment would not merely be technically possible in Indonesia but would also be economic, in the sense of not requiring very high rates of effective protection from import competition (by tariffs, subsidies or controls) with consequent economic burdens on the Indonesian user industries.

The data needed are, in effect, those required for a cost-benefit analysis of the establishment of any one of the potential equipment producing industries under consideration. Among these data are the price at which a particular piece of equipment (of adequate quality) could be produced in Indonesia as compared with the price at which it can be imported; the components of investment costs for plants of different size, alternative technologies and alternative locations; the size of the domestic market for each type of equipment (and potential export market, e.g. under regional complementation arrangements within ASEAN) that can be expected over the next (say) decade which, in turn, depends on such factors as the likely growth of demand for the finished product (rubber, sugar, etc.), the degree of capacity utilisation and likely rate of replacement demand for existing equipment and the likely rate of obsolescence due to technical change.

It will be apparent that the detailed analysis needed to answer the questions posed in the terms of reference for this study not only presented major data problems but also an analytical task which could not be attempted in the few man months available. In general, the discussion in the industry chapters focuses on technical feasibility. (At various points, to emphasize this fact, the phrase that production of such and such an item is or may be "technically" possible in Indonesia has been used). All recommendations for the establishment or expansion of equipment producing facilities in this report should therefore be regarded as provisional, subject to confirmation by means of detailed sub-sectoral studies of economic, as contrasted with merely technical, feasibility.

The next two chapters present a brief review of theoretical criteria for selection of industries for domestic equipment production and a report of impressions on the present state of the Indonesian equipment producing industry found by a UNIDO mission during field work in October - November 1983. The industry chapters deal each with one of the selected industries except the first which deals jointly with coconut and palm oil. A concluding chapter brings together the main findings and recommendations.

The next two chapters deal respectively with selection criteria for local production and with the present condition of equipment production in Indonesia. Then follow seven industry studies. For ease of reference, each of these has as far as possible the same structure, as follows:

- X.1 Raw material production (e.g. sugar, natural rubber)
  - X.1.1 The present situation
  - X.1.2 Future prospects

- X.2 Processing
  - X.2.1 Processing technology
  - X.2.2 Processing equipment
  - X.2.3 The processing industry

X.3 Equipment Production (in Indonesia)
  X.3.1 The present situation
  X.3.2 Future prospects

X.4 Investment implications

X.5 Recommendations

Chapter II Criteria for Selection:

Most of this part of the report is devoted to an examination of the potential for development of domestic production in Indonesia of equipment for a number of industries which the Government of Indonesia has suggested to UNIDO as most appropriate in terms of economic and technical criteria. The purpose of this preliminary chapter is briefly to review the criteria that must guide policy makers in planning future development of processing and processing equipment producing industries.

2.1 Processing Industries

Indonesia already has a wide range of industries processing domestically produced raw materials. Among them are industries processing foodstuffs (such as rice, other staple foods, and cash crops including sugar, tea, coffee, etc.); agricultural raw materials, such as rubber, palm oil; timber; crude oil and minerals.

Processing may be for export or for the domestic market. If raw materials are at present exported in unprocessed form, a policy of further domestic processing before export is called "export substitution". If a domestically produced raw material is processed abroad for reimport into Indonesia in processed form (e.g. crude oil refined in Singapore or rubber processed abroad for import into Indonesia of the processed product), a policy of domestic processing implies import substitution.

The question whether export or import substitution through the establishment of additional processing industries is desirable depends on the prospects of efficient domestic production. The mere fact that a new industry processes domestically produced raw materials does not, in itself, prove that its establishment constitutes a more efficient use of scarce resources than some alternative industrial development. But there is a presumption that import substitution in the case of domestically produced raw materials reimported in processed form will be economic, other things being equal, if only because of saving in transport costs.

In the case of export substitution, there is much less ground for such presumption. The question whether further processing (e.g. mineral smelting or rubber processing) at home of products intended for export is an economic use of resources cannot be answered a priori. If the domestic processing industry can be made to operate more efficiently (in terms of costs and quality) than the foreign processing industry it replaces, the domestic export industry will benefit by improved international competitiveness. If it operates less efficiently, the domestic export industry will suffer. Even in terms of net foreign exchange saving, the effect on the balance of payments may be negative. (An example is import replacement in shipping, if the net effect is higher freight charges which reduce the competitiveness of the country's export industries.)

2.2 Processing equipment industries

Similar but distinct questions are raised by a policy of import substitution through the domestic production of processing equipment (machinery, etc.). The question is whether an existing (or prospective) processing industry should be supplied with machinery through domestic production instead of imports. An example might be domestic production, instead of imports, of crumb rubber plants or rice mills or petroleum refinery equipment.

Clearly, the last example almost certainly rules itself out. Petroleum refinery equipment is extremely capital and technology intensive, beyond the present capacity of domestic production in Indonesia. Any attempt to undertake import substitution in this kind of activity would have extremely adverse effects on the user (refinery) industry.

The case of crumb rubber factories or edible oil processing plants is quite different. Except for some components (such as screw presses and hydraulic systems), crumb rubber factories employ relatively simple kinds of machinery, with no very high requirements in terms of skills, capital or technology. Much the same applies to a good deal, though not all, of the equipment used in processing staple food or cash crops. The great advantage in selecting such processing equipment for import substitution, in preference to other engineering industries, is that by assumption a substantial market exists. A large volume of output is produced in Indonesia by the user industries and most of this output requires machinery-using processing. Future demand prospects depend on the expected rate of growth of demand and productive capacity for products and on the demand for machines for replacement of existing stock in the processing industries.

Here again, it cannot be taken for granted that import replacement will necessarily be an economic proposition. If a new domestic processing-equipment producing industry (e.g. producing rice mills or crumb rubber plants) is uncompetitive with imports in price and/or quality of product and can operate only under cover of considerable tariff or other protection, the effects on the raw material producing (rice or rubber) industries may be disastrous. Conversely, if the new industry is able to adapt its machines knowledgeably to the special requirements of the domestic raw materials and the tastes and needs of (foreign and domestic) markets, it may yield external economies in the agricultural sector.

In general, in a country at Indonesia's present stage of industrial development, prospective volume of demand (depending on prospective productive capacity for the raw material and demand for the processed product) and relatively low requirements in terms of capital, advanced skills and sophisticated technology will be prime criteria in the selection of particular processing equipment industries.

There are some other considerations, often called "developmental" or "social", although economists would prefer to think of them as dynamic or involving externalities, which may reasonably modify conclusions reached on the basis of the preceding criteria.

There are, first, the external economies which may be yielded by the development of new industries in a developing country. These may take the form of widening of the market for complementary inputs, for infrastructure and, through the additional income generated, for finished goods. They may also include the favourable effects on skills of management and workers which are sometimes referred to by the phrase "learning by doing". There is no doubt that such externalities may justify, from a longer-term social point of view, investment that would not appear economic in the short-run or attractive to private investors. But the uncertainty of such external effects, and the virtual impossibility of quantifying them, make reliance on them as a guide toinvestment decisions dangerous - at best an act of faith, at worst an excuse for malinvestment of scarce capital and protection of vested interests.

Secondly, it is arguable that domestic capital goods production in a developing country, such as Indonesia, may help overcome the difficulty that most modern machinery is made in advanced industrial countries, designed primarily with a view to their factor proportions and available skills, and may be unsuited to the very different conditions of developing countries. In principle, domestic production could aim at producing machinery of a simpler kind, embodying a more labour-intensive technology (sometimes called "intermediate" technology) and could develop the skills needed to adapt imported equipment to local conditions. Here again, the case has merit but experience in various parts of the world where attempts have been made to develop "intermediate technology" equipment has not been very convincing. The most efficient "simple" machines for developing countries tend to be produced in advanced industrial countries with the technology and facilities for high-quality, cheap mass production. The case for developing, even at some cost, the skills needed to adapt, maintain and repair imported machinery is much stronger.

Thirdly, it has been argued that equipment producing industries ought to be developed for their employment-creating effects, even if the equipment cannot compete, in quality or price, with imported kinds. This is a dubious and potentially dangerous argument. There is no particular advantage, from the point of view of employment creation, in import substitution for capital rather than consumer goods. Indeed, it can be argued that in the case of consumer goods the costs, in terms of price and quality, of inefficient import substitution for the sake of employment generation merely falls on consumers, while in the case of capital goods it may damage the competitiveness of user industries and end up destroying rather than creating jobs.

Finally, there is the case for the development of equipment producing industries which rests on the potential location of such industries in less developed regions of a country. In Indonesia's case, it can be argued that, if for reasons of transport costs, equipment producing industries for timber, rubber, sugar and cash crop processing industries are economically located near the (processing) user industries on the outer islands, such development can usefully contribute to regional development. This case may have some validity, but here again, it needs to be demonstrated that the user industries (and indirectly the producers of the rubber, cash crops and other raw materials) would not be disadvantaged by such location of equipment production.

Chapter III Indonesia's Present Processing Equipment Industry: Inadequacies and Constraints

Some of the metal working enterprises in Surabaya, Jakarta, Bandung and Medan that are either already producing equipment or spare parts for processing industries or have the potential to do so, were visited by a UNIDO mission in October-November 1983 in order to assess their current capability. The following is a brief outline of the mission's impressions.

Plant and machinery

The most striking impression was that most of the machine tools and other equipment used are very old and of obsolete design. In many machine shops the machines are driven by overhead power shafts. With such machines it is not possible to achieve the necessary tolerances, working accuracies, surface finishes, or rates of metal removal required in the machining and production of components for modern machinery.

The machine shops generally lack the necessary families of machine tools, particularly milling, grinding and boring machines, which are required for their products. The same applies to production machines such as turret lathes, production aids and accessories on machines, and jigs and fixtures . Some of the units had their own foundries. These, however, were also ill equipped. It was evident that investment in machine tools and equipment had been completely neglected over long periods.

Plant layout

The older establishments suffer from very poor layout of the plants which in some cases was designed as long as fifty years or longer ago. In some of the shops the space around the machines was so cluttered with rejected and scrapped parts of which seemed not to have been cleared for years, that it was unsafe to move around. There is clearly inadequate appreciation of the fact that orderly work flow, productivity and costs of handling to a large extent depend on the plant layout.

Production Engineering

With one exception, none of the establishments visited practised production planning or production control. There were no operation layouts accompanying the drawings and components, giving instructions on the selection and size of raw material, sequence of operations, selection of speeds, feeds and depths of cut, tolerances, selection of tooling, jigs and fixtures and machines, etc. Without such instruction proper production of the components and even control of production itself is difficult if not impossible. Nor were there job cards, recording the timing of the operation workers. Without such records it is impossible to arrive at the number of labour hours and machine hours spent on the manufacture of a component or assembly of a group of equipment from which, together with labour and machine hour rates, the costs of production can be ascertained. All these engineering practices are clearly essential for proper financial and production management.

Engineering design

The designs for the equipment were invariably obtained from the foreign contractors of the processing plants. In the case of joint venture establishments, the foreign partner provided the designs which were never altered or modified by the local enterprise. The design personnel often did not know the reason why certain equipment has been designed the way it was. There was not enough time during the mission visits to study design activity in detail. It certainly appeared to be much below that required or normally found in enterprises of similar production activity.

Some of the problems of the user industry were evidently related to design aspects of the equipment. For example, the locally produced furnaces used for burning of sulphur in the sugar processing plants were of ancient design and gave endless trouble. In the same sugar mill a domestically made pump was not functioning because the hydraulic head was too small. The result was frequent breakdowns with production losses. The mission concluded that design capability is a major constraint. Another is lack of standardisation. Equipment is being manufactured to too many different standards depending upon the source of knowhow. The establishment of national standards should be given high priority.

Production processes

Casting. The basic metal forming processes are casting and forging. The mission visited foundries within enterprises in Surabaya, Bandung, Medan, etc. and one modern foundry in Gresik. The captive foundries in the old metal working establishments were ill equipped and turned out rather poor quality castings. There was no sand control or metal control. The rejection rate was very high and at places extremely poor quality castings, which should normally be rejected, were salvaged by welding and used. By contrast, in one of the metal working workshops in Bandung, engaged in the manufacture of boilers and tea processing equipment, the relatively larger size castings required for the tea rolling machines and rotor vane machines were found to be of surprisingly good quality inspite of the fact that the foundry was not properly equipped. This was the result of the work of Metal Industry Development Centre (MIDC) Bandung. The example bears witness to the latent potential of staff and workers and their ability to acquire skills quickly.

The Gresik foundry is a modern foundry with ferrous (including steel) and non-ferrous casting facilities and with automatic sand mixing, moulding, continuous moulding and casting machines. The quality of the castings is good. The foundry is able to make complicated steel castings such as the screw for an oil extraction screw press (prototype). However, its capacity is under-utilised. Utilisation is only about 40 per cent.

There is good potential to improve the quality of castings in various establishments through the efforts of MIDC or its regional branches. There is also ample scope for putting to use the existing underutilised capacity in the modern foundries.

Machining. The quality of machining in general appears to be poor. The main reason is, as already pointed out, the age of the machine tools in these establishments. In one workshop flat surfaces are generated by a very old shaping machine driven by an overhead power shaft, instead of on a milling machine.

The helical grooves on a sugar crushing roll are cut manually by hand grinding wheels. (The grooves look machine cut - the skill of the workers is highly commendable). Except in one establishment manufacturing road roller equipment, the machine tools in all establishments visited in Surabaya and Bandung are old. In Medan, a joint venture enterprise producing boilers and palm oil processing equipment has a good machine shop. Among the lowest quality of machining noticed was a metal working workshop in Medan engaged in making, among other metal fabricated products, some equipment for palm oil extraction plants. The few very old machines tools in use were in open sheds, guideways and spindles sand laden.

It is quite clear that unless new machines are installed in these plants, production of equipment for processing plants of the required quality cannot be expected.

Welding. In most of the shops visited, the quality of welding, both in arc welding and gas welding, is very high. Automatic submerged arc welding is used in the boiler manufacture in a Medan enterprise. The welding done on parts and components required for equipment ranging from simple tanks, bins, hoppers, etc., to low pressure vessels and boilers, appears to be satisfactory and appropriate to the functional requirements of the equipment. It can be said that the skills required for welding in the fabrication of equipment for the processing industries is available in most of the existing establishments.

Quality

The quality of the product in most of the establishments visited was unsatisfactory. Judging by the machine tools and other equipment used in the enterprises, and the lack of any quality control, it was doubtful whether dimensional and form accuracies, tolerances and fits of mating parts were adhered to. The consequences could be observed in the user industry. For example, the digesters in the palm oil extraction process and the screw conveyers and elevators in the kernel recovery station in a palm oil factory were found to be of extremely poor quality. The digester was subject to many breakdowns. The screw conveyers were rickety and far below their functional requirement.

Another deficiency is in the heat treatment, such as hardening, tempering, toughening, required for some of the components. It was noticed that some establishments claim to be able to produce equipment for processing of one or the other product but because they lack basic facilities are in fact producing and supplying products of extremely poor quality. As a result the processing industry, burdened with unproductive machinery, is liable to deteriorate into an inefficient and uneconomic industry, with serious consequences particularly in the export markets.

Management

Management in most of the establishments visited had no systems for production control and cost control. Few had any idea about the cost of production of their products. The product mix was at random. The lack of adequate production management and financial management can adversely affect the long-term development of the equipment manufacturing industry.

Maintenance

In one of the plants visited there was some machine tool reconditioning activity but in the older establishments there was no systematic maintenance of machines. Perhaps the old machines were beyond any maintenance. But, unfortunately, the same attitude was shown towards more recent machines.

Marketing

A deficiency of which the field mission was made aware in interviews relates to the marketing of products where these are not produced on order or commission. Marketing could present special problems if attempts were made to direct production of processing euqipment to exports as well as home markets. The need to build up a marketing capability, including international contacts, experience in assessing market opportunities and design requirements in overseas countries, as well as export credit and other promotion facilities, represents a key prerequisite for effective export orientation of manufacturing industry. All but the largest manufacturers will depend for effective marketing on the co-operation of specialised trading companies.

Major constraints and requirements

The foregoing discussion of the existing situation highlights the following constraints:

1. Lack of equipment
2. Absence of production engineering (planning and production control) practices
3. Inadequate engineering design capability
4. Inadequate machining skills
5. Absence of quality control
6. Low level of management capabilities (production, marketing and financial)
7. Almost complete absence of systematic maintenance.

It is a formidable list. This assessment of the present capability is not meant to conclude that no processing equipment can be or should be domestically produced. The object is to ascertain what is required for efficient domestic production.

Apart from lack of equipment which can be remedied only by new investment, the other technical constraints point to the following requirements:

1. Development of adequate engineering and management skills, for production planning, quality control, general management, marketing, etc.
2. Development of design personnel, establishment and application of standards; acquisition and development of tool, jig and fixture design.
3. Development of machinists and line personnel, such as supervisors, foremen, etc.
4. Introduction of quality control systems, including inspection and quality control personnel.
5. Development of higher quality production and financial management.
6. Introduction of maintenance procedures, including preventive maintenance and personnel to carry out maintenance.

Chapter IV Edible Oil Processing Equipment

4.1 Edible oil production

4.1.1 The present situation

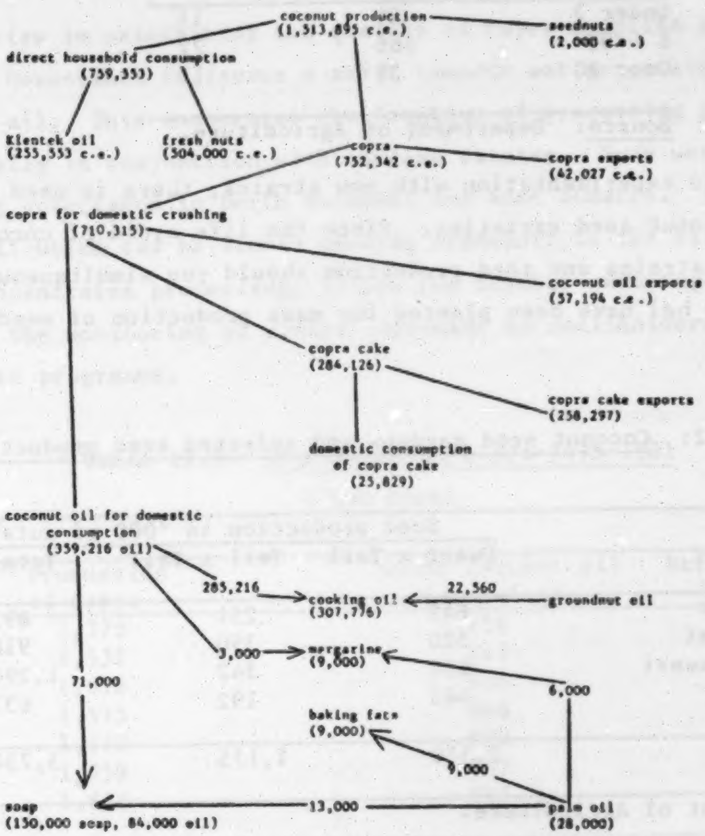
A chart published in 1974 shows schematically (and with data relating to 1972) the complex structure of the Indonesian edible oil industry and the place of coconut and palm oil in this structure (Figure IV.1). Nearly one-half of domestic coconut production went direct into household consumption, in the form of fresh nuts or klentek oil. The other half was processed into copra of which a small proportion was exported as such, the rest domestically processed, partly into copra cake for domestic consumption or export, partly into coconut oil for domestic consumption, in the form of cooking oil, margarine and other cooking fats, soap, etc. Fresh coconut, as well as ground nut and palm oil were other inputs for these purposes.

In the past decade, the main change has been a fourfold increase in domestic palm oil production (since 1969), largely for export, while domestic production of coconut has failed to keep up with domestic demand, so that Indonesia has become a net importer. Crude palm oil was expected to become one of the major foreign exchange earners among the country's non-petroleum exports. However, faced with severe shortages of crude palm oil in the domestic market and rising prices, the Government has reversed its policy by clamping down on crude palm oil exports. In the long run the Government is planning to raise coconut oil production channelled primarily for domestic consumption, thus freeing more crude palm oil for export markets. It is against this background that the present situation and future prospects of the edible oil industry must be viewed.

Coconut Growing. Indonesia is the second largest coconut producer in the world (after the Philippines) with 2.2 million ha. Smallholders account for virtually all (98 per cent) of total production.

After decades of failure to replace aging trees (Table IV.1) and consequent decline in yields - the current national average yield is less than

Figure IV.1
Coconut Disposition 1972
(based on household consumption survey data)
(tons)



c.e.= copra equivalent

Source: Bulletin of Indonesian Economic Studies, November 1974.

one ton per ha - the Government has embarked on a rejuvenation-replanting programme with an annual goal of 35,000 ha. For successful replanting, coconut varieties are needed that are hardy and tolerant of a wide range of environmental conditions and give satisfactory yields (2-4 tons of copra per ha per year with low inputs). The coconut breeding programme has developed varieties with these characteristics. Coconut palm planting is also being linked to the family planning programme through the provision of seedlings as an inducement to acceptors under the programme.

Table IV.1: Ages of Indonesian coconut palms

Age (years)	Palm numbers (million)	%
Under 7	24	11
8 - 60	166	72
Over 60	39	17

Source: Department of Agriculture.

In addition to experimentation with new strains, there is need for a large production of coconut seed varieties. Since the life cycle of coconut is long, testing of strains and seed production should run simultaneously. Four seed gardens (490 ha) have been planted for mass production of seed (Table IV.2).

Table IV.2: Coconut seed gardens and selected seed production

Location	Seed production in '000 of nuts		
	Dwarf x Tall	Tall x Tall	Total
Pakuwon, West Java	642	251	893
Paniki, N. Sulawesi	520	390	910
Bone Bone, S. Sulawesi	952	342	1,294
Paya Gajah, Aceh	445	192	637
Total	2,559	1,175	3,734

Source: Department of Agriculture.

Coconut processing. With declining yields of the existing stands of copra palms and long lags before the rejuvenation programme can show results, production of copra and coconut oil has been outstripped by domestic demand. This has changed Indonesia from being a substancial exporter in 1970 (185,000 tons) to that of a net importer. In 1980, the diversion of palm oil to the domestic market allowed some 19,000 tons of copra to be exported, and some results of replanting are now beginning to show. But the increase in output continues to be fully absorbed by the domestic market; there were no exports in 1981 and 1982. Copra production over the years 1975-81 is shown in Table IV.3. (The figures for crude and refined coconut oil equivalents are based on an assumed yield of 55 per cent for the extraction of oil from copra and 94 per cent for the refining of the crude oil). Exports of copra cake amounted to 317,000 tons in 1979. Total employment in coconut oil refining in 1981 was 5,428 in 99 establishments producing a value added of about Rp. 256 thousand million.

Difficulties in maintaining the quality of copra supplied by smallholders have led the Government to favour a shift towards wet processing of coconut into coconut oil. This encourages the location of processing plants in rural area, especially in conjunction with nucleus estates. Such wet processing is already being undertaken in North Sulawesi and West Sumatra. It produces a raw edible oil which can be stored pending transport to the refinery. In so far as it concentrates processing, it has the further advantage of facilitating the monitoring of credit repayment by smallholders under the nucleus estate programme.

Table IV.3: Production of copra 1975-1981

('000 tons)

Year	Production of Copra	Crude coconut oil equivalent	Refined coconut oil equivalent
1975	1,375	756	711
1976	1,532	843	792
1977	1,518	835	785
1978	1,575	866	814
1979	1,582	870	818
1980	1,759	967	909
1981	1,812	997	937

Source: Quarterly Economic Review Indonesia Annual Supplement, 1983 Economic Intelligence Unit, London.

Palm oil growing. Indonesia's palm oil industry consists of large estates. By 1981, the total area covered by oil palm estates had risen to almost 290,000 ha. Recent development of the area under oil palm is shown in Table IV.4. The total number of estates is 53. They are concentrated in North Sumatra (more than 90 per cent of total area), the remainder being located in Aceh, Riau, Lampung, West Java and Kalimantan.

Since harvested fresh fruit bunches (FFB) must be processed within a specified time, all estates have a primary processing facility. After extraction the crude oil can be stored without damage for a considerable time and transported to central secondary processing units. This fact also determines the structure of the industry. In all cases, plantation and processing are combined in a single company. There were 31 locally owned companies in 1982. The sector is also open for foreign investment.

Table IV.4: Area development of oil palm plantation, 1977-1981
('000 ha)

Year	Extent	Increase (%)
1977	223	
1978	244	9.5
1979	251	2.4
1980a/	271	8.3
1981a/	288	6.2

Source: National Agency for Export Development, Palm Commodity Note - 1979.
a/ Estimates.

Palm oil processing. Palm oil production grew extremely rapidly from 189,000 tons in 1969 to 497,000 tons in 1977. Since then growth has continued at a steady though slower rate (Table IV.5). Gross value of output was Rp. 73.6 billion and value added Rp. 19.2 billion. The proportion of palm oil output exported fell from 85 per cent in 1977 to 25 per cent in 1981 (Table IV.6). The 31 palm oil processing units operating in 1982 have a total capacity of 944,260 tons of refined oil; but the policy change of 1980 led to a fall in output to only 526,926 tons in 1982, since domestic demand did not increase sufficiently to offset the fall in exports.

Table IV.5: Production of palm oil and palm kernel 1977-82
('000 tons)

Year	Palm Oil		Palm Kernels	
		Increase (%)		Increase (%)
1977	497		92.	
1978	525	5.5	99.	7.7
1979	600	14.3	113.	14.1
1980	691	15.2	121.	6.8
1981	707	2.3	126.	4.4
1982	807	14.1	144	14.3

Source: Economic Indicators, Central Bureau of Statistics, August 1982. 1982 Figures: Quarterly Economic Review of Indonesia, No. 2, 1983, The Economist Intelligence Unit.

Table IV.6: Exports of palm oil and palm oil kernel 1977-1982

Year	Volume ('000 tons)				Value (US $ million)			
	Oil	Kernels	Total	Change	Oil	Kernels	Total	Change
1977	421.0	26.6	447.6		192.8	5.8	198.7	
1978	412.3	7.0	419.3	-6.3%	208.4	1.5	209.8	+5.6%
1979	437.8	30.6	468.4	+11.7%	253.7	11.0	264.7	+26.1%
1980	434.3	32.9	467.2	-0.3%	215.4	8.1	223.5	-15.6%
1981	176.4	23.6	200.0	-57.3%	78.1	4.8	82.9	-62.9%
1982	230.0							

Source: Bank Indonesia, Weekly report No. 1236, dated January 6, 1983. 1982 Figures: Quarterly Economic Review of Indonesia, No.2 , 1983, The Economist Intelligence Unit.

4.1.2 Future prospects

Repelita IV target figures for copra production, exports and consumption over the period 1984-88 are given in Table IV.7. (As yet, no data for wet processing are available). The planned increase by 61 per cent between 1981 and 1988 is reported to be based on the number of seedlings planted in earlier years and the assumed gestation period and production volume of the hybrids planted. Target production of crude coconut oil would leave more than one million tons of copra per year for other uses (Table IV.8).

Table IV.7: Production, exports and consumption of copra 1984-1988
('000 tons)

	1984	1985	1986	1987	1988
Production	2,065	2,177	2,316	2,657	2,914
Exports	378	365	459	649	746
Consumption	1,687	1,882	1,857	2,008	2,168

Source: Directorate General of Multifarious Industries.

Table IV.8: Production of coconut oil and domestic copra residue 1984-1988
('000 tons)

	1984	1985	1986	1987	1988
Coconut oil	374	335	400	412	428
Copra required for above	680	609	727	749	778
Copra left for other consumption	1,007	1,273	1,130	1,259	1,390

Source: Directorate General of Multifarious Industries.

Table IV.9 presents the projected production of refined coconut oil over the period 1984-88. Up to 1986, not all of the crude oil is to be refined; for 1987 the figures balance; beyond 1987, the crude oil deficit for refined oil producton is to be covered from accumulated stocks.

Table IV.9: Production of refined coconut oil and crude oil residue 1984-1988
('000 tons)

	1984	1985	1986	1987	1988
Production of refined oil	277	305	353	387	424
(Crude) coconut oil required for above	295	324	376	412	451
Surplus (deficit) above refinery requirements	79	11	24	-	(-23)

Source: Directorate General of Multifarious Industries.

During Repelita III new oil palm plantations totalling 96,000 ha were planted which will start production during Repelita IV. Crude palm oil output will, it is hoped, more than double from 1984 to 1988 (Table IV.10) and reach more than five times the output of 1982. Most of this crude oil will be available for export, since local consumption is estimated to rise by only about five per cent per annum.

Table IV.10:: Projected production and exports of palm oil, 1984-88
('000 tons)

	1984	1985	1986	1987	1988
Total crude palm oil production	1,230	1,540	1,920	2,500	2,850
Crude palm oil for exports	120	310	650	1,180	1,490
Crude palm oil for domestic processing	1,110	1,230	1,270	1,320	1,360
Refined palm oil for domestic consumption	670	740	760	790	820

Source: Directorate General of Multifarious Industries.

4.2 Processing

4.2.1 Processing technology

The processing of coconut and palm oil proceeds in two stages:

(i) the extraction of oil from coconut, copra, palm fruit or kernel (primary processing);

(ii) the refining of the oil (secondary processing).

Primary processing: coconut oil. The first stage of the traditional method of primary processing of coconuts is production of copra. After harvesting, the coconuts are cut into pieces and sun-dried for one day. Drying is then continued in simple kilns of varying design in different regions. Coconut husk or other traditional fuels are used for firing. The kilns are made locally of available wood or bamboo. A normal drier has a batch capacity of 1,000 nuts (moisture content: about 50 per cent) giving after two to three days about 220 kg of copra with 6 per cent moisture content. The investment in the kiln is estimated at US $200 for 100 tons annual dry copra. The quality of copra depends upon the maturity of the nuts, the extent and conditions of drying, the storage and handling conditions and, to some extent, the variety of the coconut palms. An alternative method, wet processing, involves extraction of oil from fresh coconut.

There are three general methods of oil extraction from copra: the full-press or mechanical method, the prepress-solvent method, and the full-solvent method. In the full-press method the prepared material is pressed between the screws (worm) and the cage (slitted steel bars). In the prepress-solvent process, the copra is partially de-oiled by preliminary low-pressure mechanical extraction and then subjected to solvent extraction to remove most of the oil left. The oil content of the prepressed cake ranges from 16 to 20 per cent for optimum operations. The equipment used for prepressing may be similar to expellers for full-pressing (with adjustments for higher throughputs) or a special prepressing expeller with single pressing screw. The equipment for solvent extraction consists of two general types: the roto-cell type with cells revolving around a vertical axis; and the basket type, with baskets travelling horizontally, while the dissolving liquid is sprayed over the material in counter-current flow. In the full-solvent process, the prepared copra is first subjected to a first extraction (percolation), using the weak miscella from the second extractor as starting solvent, and producing the strong miscella for oil recovery. The extracted meal is first flaked and then subjected to a second extraction (immersion) which uses fresh solvent as starting solvent and produces the weak miscella solvent for the first extractor.

The oil from the expellers contains substantial quantities of solids that have to be removed before the oil is pumped to the storage tanks. The oil is cleaned in two stages: first, by settling and screening, and then by filtration. The screening equipment is a rectangular steel tank equipped with a continuous drag chain conveyor with scraper blades which scoop the settled solids and lift them over a fine screen for drainage at one end of the screening tank and convey them back to the expellers to be mixed with the copra. The filtering equipment is generally a plate and frame filter press with canvass filtering media. Some plants use leaf filters with perforated steel filtering leaves. The foots or filter cake from the filters are recycled to the expellers for oil extraction.

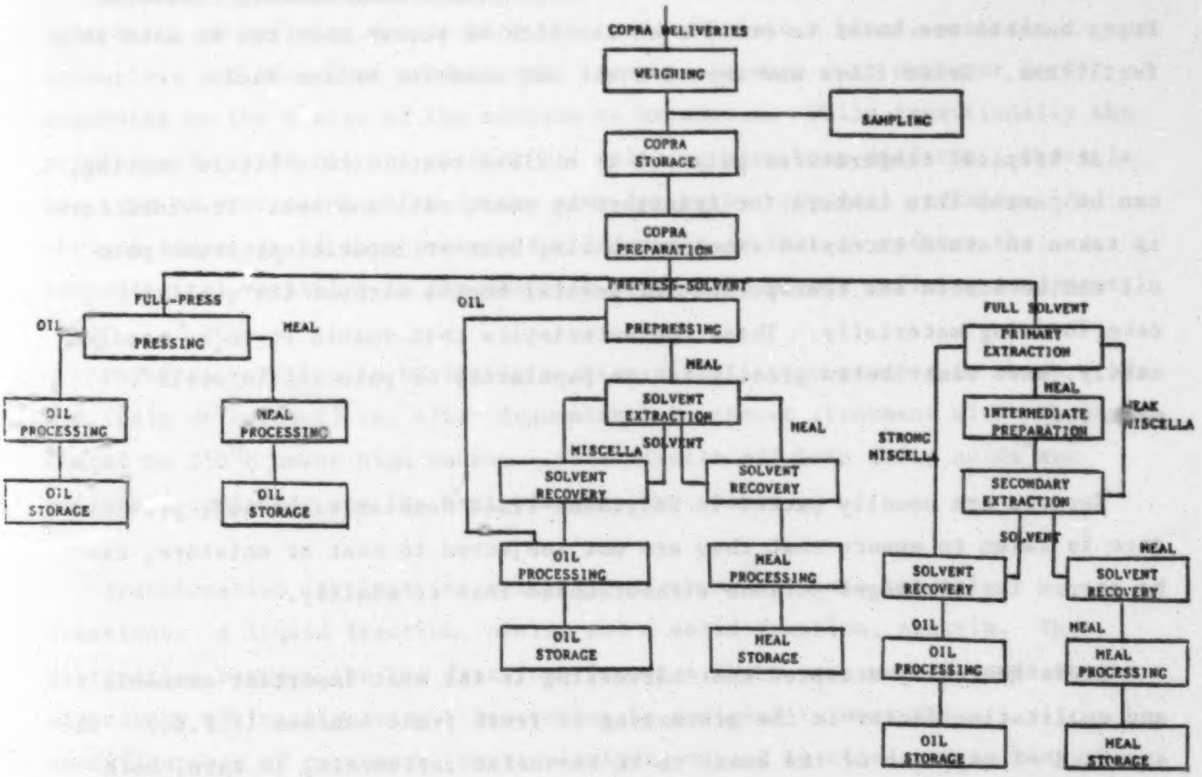
The copra cakes which leave the expellers at about 100°C. are further processed in cake coolers. The cakes cascade down the cooler baffles and are cooled by a cross-flow of cool air from blowers. After cooling they are ground to fine particles by hammer mills or disk mills. The ground cakes may be bagged for the local market or pelletised for export.

The coconut oil is stored in vertical cylindrical storage tanks usually made of steel. Since they are normally installed outside the buildings, they are equipped with covers, usually conical. Top and bottom manholes are provided for cleaning.

The following simplified flow diagram illustrates the stages of processing described in the preceding paragraphs (Figure IV.2).

The technology for wet processing of coconut is basically similar to the mechanical process of the extraction from copra. The main difference is the need to reduce the water content by heating to accelerate evaporation.

Figure IV.2: Simplified general flow diagram copra oil extraction



Primary processing: palm oil. Oil-palm cultivation and processing must always be organised together because of the need to process the fruit as soon as possible after harvesting .

In good growing conditions, commercial plantings of oil palm can yield annually up to 32 tons of fresh fruit bunches (FFB) per ha during their 25 year life. There are considerable variations in fruit, oil and kernel owing to climate and soil conditions. Although there are peaks and troughs in fruit production, oil-palm yield throughout the year and a permanent work force and reliable processing facilities are essential.

The initial objective in processing the FFB is to get the saleable products into a stable form in which they can be transported and marketed. Extraction rates of 21 per cent and 4 per cent for refined oil and kernels respectively can be expected from a well-run factory. Recent research has shown that other useful by-products can be recovered from factory residues. Empty bunches are burnt to provide an ash rich in potash that can be used as a fertilizer. Dried fibre and kernel-shell are used for boiler fuel.

At tropical temperatures palm oil is a fluid that, with a little heating, can be pumped into tankers for transport by road, rail and sea. Provided care is taken to avoid excessive exposure to air, heat or impurities, crude palm oil can be stored and transported for several months without its quality deteriorating materially. These characteristics that enable it to be handled easily, have contributed greatly to the popularity of palm oil in world markets.

Kernels are usually packed in polythene-lined hessian sacks and, provided care is taken to ensure that they are not subjected to heat or moisture, can be stored for prolonged periods without undue loss of quality.

It is generally accepted that harvesting is the most important economic and qualitative factor in the processing of fresh fruit bunches (F.F.B.). The standard of ripeness of the bunch to be harvested influences, in turn, both the rate of extraction and the level of free fatty acid (F.F.A.) in the oil extracted. It is of course desirable to achieve the highest possible extraction of oil, while its F.F.A. content should be as low as possible. In practice, these aims conflict, since the riper the fruitlets are on a palm bunch the more easily they become bruised and this in turn causes F.F.A. to develop.

The primary process involves sterilising the F.F.B. for about 70 minutes at a steam pressure of 3 kg/cm^2. This arrests the build-up of the free fatty acid content and loosens the fruit from the bunches. Thereafter, the fruit is stripped from the bunches and stirred into a homogenized mass to rupture the oil-bearing cells. The crude oil is expelled from this mass by presses and passed through a series of cleaning or clarification stages where moisture and other impurities are removed. The residual fibre and nut mixture is passed from the presses through an air column where the nuts are separated prior to cracking for recovery of the kernel.

Secondary processing: edible oils. The main objectives of secondary processing or refining are to turn the crude oil into a bland, neutral, colourless and odourless product that can then be made into consumer goods according to the tastes of the markets to be served. While traditionally the processes for palm oil and coconut oil refining have been different, there is one type of processing which is the same for both: physical refining. An obvious advantage of this process for Indonesia is that it reduces the technological variables in the domestic production of oil [illegible] equipment.

Physical refining is basically a steam distillation process, in which crude oil (palm or coconut) is, after degumming but without treatment with alkalis, heated to 250°C under high vacuum. This distils off both fatty acids and odiferous compounds and the heat bleaches the oil.

Fractionation involves the splitting of crude oil into two main fractions. A liquid fraction, olein, and a solid fraction, stearin. The distinction between the two fractions is not a sharp one; much depends on the efficiency of fractionation. Processing is designed to meet the specifications of customers, particularly in regard to cloud and melting points.

4.2.2 Processing equipment

To illustrate the considerable range of equipment needed by the edible oil processing industry, Table IV.11 lists the major items needed by the palm oil extraction industry alone. Similar lists could be given for the coconut oil extraction and the edible oil refining industries.

4.2.3 The processing industry

The installed capacity in the Indonesian coconut oil extraction industry was 853,870 tons per annum in 1980, spread among 379 enterprises. Actual production was only 325,000 tons. The small average capacity per enterprise indicates that a large proportion of the processing units are small-scale. There is also substantial excess capacity. Assuming 80 per cent normal capacity utilisation, production could be raised up to 683,000 tons per annum with existing capacity, equivalent to a copra intake of 1,242,000 tons per annum. Since the volume of copra to be milled over the period 1984-1988 does not exceed 778,000 tons per annum (Table IV.12), it appears that no additional capacity in coconut oil extraction is required during Repelita IV and beyond, until the requirement reaches at least 1 million tons. A shift to wet processing could require additional capacity in the outer islands regions where the coconut is grown. Projected capacity for wet processing units is 1,000 tons/year of end product, operating on a two-shift basis.

Table IV.11: Process equipment required for crude palm-oil extraction

Type of Equipment	Quantitiy
Fruit reception station	
bunch hopper	1
steriliser cages	2
bogies	30
Sterilising station	
horizontal steriliser	2
inspection platform	1
Threshing station	
threshing machine	2
traverse screw conveyor	1
Empty bunch incinerator	
conveyors	2
incinerator	1
Processing station	
elevator and conveying equipment	set
digester	3
screw presses	3
equipment for conveying oil and press cake, screened fibre, crude oil tanks, vibrating screen	set
Clarification station	
continuous oil clarification tank	1
sludge tank	1
sludge separator	2
clarified oil tank	1
centrifuge purifier	2
structurals	set
collecting tank for cil sludge	1
hot process water tank	1
Depericarping	
steam hacketed cake breaker conveyor	1
vertical pneumatic depericarping	1
penumatic fibre transport	1
fibre cyclone	1
ducting	set
structurals	set
Kernel recovery station	
elevators	4
screw conveyors	8
silos	4
ducting	-
structurals	-
dryers	1
cyclones	2
Storage	
storage tanks	2
structural, piping, etc.	set

Table IV.12: Production and consumption of vegetable cooking oil, refined coconut and palm oil, 1984-1988
('000 tons)

	1980	1984	1985	1986	1987	1988
Coconut oil						
-production of copra	591	680	609	727	749	778
-crude oil	325	374	335	400	412	428
-crude oil for refining	276	295	324	376	412	451
-refined oil	232	277	305	353	387	424
Palm oil						
-crude oil	533	1,110	1,230	1,270	1,320	1,360
-refined oil	320	670	740	760	790	820
Total refined oil	552	947	1,045	1,113	1,177	1,244
Domestic a/ consumption of cooking oil		812	882	958	1,040	1,129
Surplus		135	163	155	137	115

Source: Computations based upon Tables IV.7 - IV.10.

a/ Based on 1983 consumption of 748,000 and growth rate of 8.6 per cent per annum.

The increase in palm oil extraction capacity required to process the output of newly producing plantations during the period of Repelita IV is shown in Table IV.13.

Table IV.13: Planned increase in crude palm oil processing units (unit capacity: 60 FFB/hr), 1984-1988

Year	Number of New Processing Units	Total investment a/ (in Million US$)
1984	5	37.5
1985	9	67.5
1986	8	60
1987	6	45
1988	4	30

Source: Computations based upon Tables IV.10, 12

a/ Constant prices of 1982/83.

Existing installed capacity for edible oil (coconut and/or palm oil) refining is 282,000 tons per annum in 105 plants. Actual production in 1982 was reported to be 254,000 tons, which implies a very high (90 per cent) capacity utilisation. Additional capacity for 200,000 tons per annum will be required during 1984-88, i.e. installed capacity of 250,000 tons per annum, assuming normal 80 per cent capacity utilisation. Table IV.14 shows the required expansion of installed capacity. Table IV.15 translates these requirements into number of refinery units of various capacities and alternative technologies.

Table IV.14: Additional capacity required for coconut oil refining over period 1984/85
('000 tons per annum)

		1984	1985	1986	1987	1988
Projected production of refined coconut oil		278	305	353	387	424
Existing installed capacity as of 1982	282					
Existing production capacity at 90 % utilisation (1982)	254					
Assume 80 % for future existing production capacity	225					
Additional new production capacity required (incremental)		53	27	48	34	37
Cumulative addition production capacity required		53	80	128	162	199
Additional installed capacity required at 80 % utilisation		66	34	60	43	46
Cumulative additional capacity for refining		66	100	160	203	249

Source: Computation based on data from Directorate General of Multifarious Industries.

Table IV.15: Number of refinery units required for coconut oil 1984-1988

	1984	1985	1986	1987	1988	Total
	('000 tons per annum)					
Additional refining capacity						
required	66	34	60	43	46	249
rounded off	70	40	60	50	50	270
	(units)					
Alternative number of units						
1. continuous precleaning and bleaching						
50 tons/day(12,500 tons/annum)	6	3	5	4	4	22
100 tons/day(25,000 tons/annum)	3	2	2	2	2	11
2. Physical Refining						
100 tons/day(25,000 tons/annum)	3	2	2	2	2	11

Source: Computation based on data from Table IV.14.

4.3 Equipment production

According to Ministry of Industry data, there is a limited production of coconut processing equipment in Indonesia. In 1980, 40 items of equipment, valued at Rp. 21 million, are reported to have been produced. For the palm oil sector, the field work mission identified seven producers of equipment. Of these, five were in Medan and two in Surabaya. The technology used consisted of manual welding and machining on general purpose machine tools.

Of the seven palm oil equipment producers, only three are capable in principle of acting as general contractors for equipment for crude oil extraction, two in Medan and one in Surabaya. All three need strengthening of their engineering capability in varying degree. In addition, there are four companies acting as sub-contractors, three in Medan and one in Surabaya. Their engineering capability and quality of product, however, are unsatisfactory. Poor quality of machining and finishing are mainly responsible.

None of the following items of equipment for primary processing of palm oil is as yet produced in Indonesia: screw presses, sludge separators, hydrocyclone wear-resistant separator heads, balanced impellers for centrifugal forms, sub-assemblies or components such as variable drive for nut crackers, air heating batteries for nut and kernel drying, hydraulic cylinders and pump for hydraulic door operations in the fruit unloading ramp, dished ends and steriliser doors made from boiler plate, recording and control systems for the steriliser, conveyor belting, idler supports for empty bunch conveyors, agitator arms in digestors, level indicators in the tanks for crude oil.

As to coconut oil extraction, similar data were not obtainable during field work. There has been traditional manufacture of equipment for copra production and also for small and medium scale oil extraction. In view of the similarities in the processes for primary processing of coconut and palm oil, it may be assumed that domestic production (or local content) is at much the same level. This would suggest that some equipment categories, such as hammer mills, filter presses and pellet mills, are still imported.

The equipment for refining, both of palm oil and of coconut oil, is still wholly imported, except for local civil works and some mechanical steel structure components.

4.4 Investment implications

The unit price of domestically produced palm oil extraction machinery and equipment is Rp. 9 billon, equivalent to US $ 7.5 million, for a plant with a capacity of 60 FFB/hour

The price of a mechanical extraction plant for coconut oil (full-press process) is about US $3,000 for a capacity of four tons of copra per day, US $800,000 for fifty tons per day and US $2.5 million for 250 tons per day. The price of a pre-press advent extraction plant is about US $2.5 million for 150 tons per day.

The investment cost of equipment for an edible oil refining plant amounts to approximately US $13 million for a plant of 100 tons per day capacity (25,000 tons per annum. The auxiliary installations, such as cooling towers, boiler houses, etc. require an additional investment of US $400,000, and for erection and commissioning (say) US $500,000. Thus, total investment for equipment and installation, for a 100 tons per day plant amount to US $2.2 million. A plant of 200 tons per day capacity costs approximately US $3.4 million.

The investment implications of the required expansion of coconut and palm oil processing are therefore as follows:

Coconut oil extraction. No new investment is required for copra processing; investment requirements for wet processing are similar to dry processing. Replacement of machinery is estimated at seven per cent of installed capacity (60,000 tons per annum), i.e. approximately five plants of 50 tons per day (12,000 tons per annum) at US $0.8 million or US $4 million a year.

Palm oil extraction. The required annual investment (arithmetic mean value) is US $48 million for new extraction plants. In addition, seven per cent of 994,000 tons per annum have to be replaced annually, giving 66,000 tons per annum capacity or US $45 million. Total, in round figures: US $93 million per year.

Edible oil refining. Eleven new refineries of 100 tons per day capacity will be required. If four refineries of 200 tons per day and three refineries of 100 tons per day capacity are installed during 1984-88, total investment costs, at the previously indicated price, will be 4 x 3.4 + 3 x 2, i.e. US $20 million, or US $4 million annually for new investment. Because of the durability of the plants, the replacement investment is calculated at only four per cent of installed refining capacity of 600,000 per annum, i.e. 24,000 tons per annum or one plant of 100 tons per day, representing in round figures US $2 million. Total investment required for the refining industry is therefore US $6 million a year.

The foregoing estimates suggest that, during Repelita IV, the edible oil (coconut and palm oil) processing industries will require investment in equipment, whether imported or domestically produced, of about US $103 million annually.

4.5 Recommendations

Some crude oil extraction equipment is already produced locally and domestic production of most of the rest may be expected in due course. The situation for refining equipment is different. Some items and components present no major manufacturing problems; the reason why they are not yet produced domestically is lack of engineering capacity and knowhow in thisspecialised area. Even for crude oil extraction equipment, however, upgrading of the quality of production is extremely important for the equipment using industries.

As in the case of the sugar and cement industries, the key to further development is what in this report will be called the "general engineering contractor" (GEC) approach. This involves the establishment of one or more general engineering facilities functioning as general contractors. They would not necessarily themselves produce equipment, but would act as general contractors for local tender and sub-contracting. They should be of the joint venture type, in order to draw on the experience and knowhow of a leading international edible oil refining equipment producer for the high technology involved. Such a joint venture could at the same time cover other areas of edible oil processing, such as ground nut. One of its tasks would be to assist the government in determining the sequence in which additional equipment production should be taken up, whether through sub-contracting or through the establishment of new specialised production units.

Assuming that by 1985 some thirty per cent of refining equipment can be manufactured locally, it should be technically possible to raise the local content gradually by (say) ten per cent a year, giving the following schedule of domestic manufacture of processing equipment:

	Local content %	Annual Value of Refining Equipment Output US $ million
1985	30	1.8
1986	40	2.4
1987	50	3.0
1988	60	3.6

It is assumed that 90 per cent of oil extraction equipment can technically be produced domestically, i.e. US $87 million. Total equipment production for the edible oil sector would therefore be of the order of US $8' million a year. This would represent employment of some 4,000 persons, assuming US $15,000 per employee.

Chapter V Rubber processing equipment

5.1 Raw material production

5.1.1 The present situation

Although synthetic rubber have become increasingly important, natural rubber still has advantages as a raw material because of its versatility and for special applications (e.g. where heat resistance is important) and the steep rise in the cost of synthetic production which followed the oil price increases of the 1970s has improved the competitive position of natural rubber in world markets.

Indonesia is an important producer of natural rubber, with an average share of 25 per cent in world production. It ranks second to Malaysia among rubber producers (Table V.1).

Table V.1: World production of natural rubber, 1978-1981
(000 tons)

Country	1978		1979			1980			1981			Average	
	Vol.	Share %	Vol.	Δ %	Share %	Vol.	Δ %	Share %	Vol.	Δ %	Share %	Δ %	Share %
Malaysia	1,607	43.3	1,617	0.6	41.8	1,600	-1.1	42.1	1,590	-0.6	41.8	-0.4	42.2
Indonesia	885	23.8	964	8.9	24.9	989	2.6	26.1	963	-2.6	25.3	3.0	13.6
Thailand	469	12.6	540	15.1	14.0	510	-5.6	13.4	510	-	13.4	3.2	13.4
Srilanka	156	4.2	153	-1.9	4.0	133	-13.1	3.5	133	-	3.5	-5.0	3.8
Others	597	16.1	593	-0.7	15.3	564	-4.9	14.9	611	8.3	16.0	0.9	15.6
Total	3,714	100.0	3,867	4.1	100.0	3,796	-1.8	100.0	3,807	0.3	100.0	0.9	100.0

Source: FAO Production Yearbook, Directorate General of Estates.

About four-fifths of the area under rubber in Indonesia consists of smallholdings which account for some two-thirds of output (Tables V.2 and V.3). A programme of extension, rejuvenation and upgrading has succeeded in significantly increasing productive capacity. But actual production declined in 1981 and 1982, owing chiefly to a fall in world market price and drought which affected output. The replanting and upgrading programme follows years during which existing stands of rubber trees were allowed to age, so that productivity declined, especially in the smallholder sector, and it will take some years for the programme to become effective in terms of output. Of the large rubber estates, about half (in area and output) are state owned, the other half by private companies. The rejuvenation programme in part takes the form of nucleus estate development, largely promoted and financed by the World Bank, under which new technology is to be transmitted by estates to smallholders in the surrounding region.

Table V.2: Area of rubber plantations in Indonesia, 1978-1982
(000 ha)

Year	Smallholders Estates			Large private estates			Government owned estates			Total		
	Area	Δ %	Share %	Area	Δ %	Share %	Area	Δ %	Share %	Area	Δ %	Share %
1978	1,871	-	80.9	253	-	10.9	189	-	8.2	2,313	-	100.0
1979	1,926	2.9	80.8	271	7.1	11.4	187	1.1	7.8	2,384	3.1	100.0
1980	1,947	1.1	81.7	246	-9.2	10.3	190	1.6	8.0	2,383	-	100.0
1981	1,994	2.4	81.7	244	-0.8	10.0	202	6.3	8.3	2,440	2.4	100.0
1982	1,996	0.1	80.7	245	0.4	9.9	232	14.9	9.4	2,473	1.4	100.0
Average	-	1.6	81.2	-	-0.6	10.5	-	5.4	8.3	-	1.7	100.0

Source: Directorate-General of Estates.

Table V.3: Indonesia's production of natural rubber, 1978-1982
(000 tons)

Year	Smallholders Estates			Large private estates			Government owned estates			Total		
	Output	Δ %	Share %	Output	Δ %	Share %	Output	Δ %	Share %	Output	Δ %	Share %
1978	612	-	69.2	110.1	-	12.3	162.5	-	18.4	885.0	-	100.0
1979	673.1	9.9	69.8	121.3	10.2	12.6	169.6	4.4	17.6	964.0	8.9	100.0
1980	689.1	2.4	69.6	114.5	-5.6	11.6	185.8	9.6	18.8	989.4	2.6	100.0
1981	642.3	-6.8	66.7	127.5	11.4	13.2	193.4	4.1	20.1	963.2	-2.6	100.0
1982	549.1	-14.5	63.8	121.8	-4.5	14.1	190.1	-1.7	22.3	861.0	-10.6	100.0
Average	-	-2.3	67.8	-	2.9	12.8	-	4.1	19.4	-	-0.4	100.0

Source: Directorate-General of Estates.

The rubber which is obtained after the first stages of treatment is ranked in different qualities known as Standard Indonesian Rubber (SIR) with various specifications (Table V.4). While in the past smallholder rubber has tended to be variable and generally low in quality, upgrading, especially in processing, has greatly improved the quality and international marketability of Indonesian rubber.

Table V.4: Standard Indonesian rubber (SIR) with various specifications

Specifications	Qualities				
	SIR-5L	SIR-5	SIR-10	SIR-20	SIR-50
Maximum dirt content (%)	0.05	0.05	0.10	0.20	0.50
Maximum dust content (%)	0.50	0.50	0.75	1.00	1.50
Maximum vaporizer content (%)	1.00	1.00	1.00	1.00	1.00
Plasticity Retention Index					
Consumer limits minimum	60	60	50	40	30
Producer limits minimum	70	70	60	50	40

More than two-thirds of Indonesian natural rubber is exported as crumb rubber and about 20 per cent as rubber smoked sheet (RSS). The share in exports of crepe rubber, latex and other types has been declining, from almost 15 per cent in 1978 to 12 per cent in 1982 (Table V.5). More than two-thirds of rubber exports go to two countries (USA and Singapore), but the share of Singapore has fallen markedly in recent years (from 40 per cent in 1978 to 25 per cent in 1981) while the residual group of "other countries" increased its share from 11 to 23 per cent, a reflection in part of Indonesian efforts to diversify rubber markets (Table V.6). The value of rubber exports declined sharply in 1981 and 1982, on account of both declining production and falling prices, but they have begun to benefit from recovery in the industrial countries.

Table V.5: Volume of rubber exports by kind

(000 tons)

Kind of Rubber	1978		1979			1980			1981			1982			Average	
	Vol.	Share %	Vol.	± %	Share %	Vol.	± %	Share %	Vol.	± %	Share %	Vol.	± %	Share %	± %	Share %
Crumb	568.8	66.0	571.6	0.5	66.4	658.3	15.2	[illegible]	563.3	-14.4	69.3	579.8	2.9	72.4	1.1	68.3
RSS	167.6	19.7	167.4	-0.1	19.4	191.0	14.0	19.7	163.3	-14.8	20.1	158.8	-2.8	19.8	-0.8	19.7
Crepe	67.7	7.9	72.2	6.6	8.4	60.8	-15.8	6.2	49.9	-17.9	6.2	21.9	-56.1	2.7	-8.8	6.3
Latex	36.9	4.3	27.2	-26.3	3.2	63.9	61.4	6.5	38.1	-38.0	3.3	36.9	31.3	4.6	7.6	4.0
Others	22.1	2.6	22.4	[illegible]	2.6	21.3	-2.4	2.2	7.7	-63.8	0.9	6.0	-18.1	0.1	-28.8	1.7
Total	861.3	100.0	861.8	-0.1	100.0	975.1	13.2	100.0	813.7	-16.7	100.0	801.4	-1.5	100.0	-1.2	100.0

Source: Central Bureau of Statistics, Export Statistics.

Table V.6: Value of rubber exports by country of destination, 1978-1982
($ US millions)

Country of destination	1978 Vol.	1978 Share %	1979 Vol.	1979 Δ %	1979 Share %	1980 Vol.	1980 Δ %	1980 Share %	1981 Vol.	1981 Δ %	1981 Share %	1981 Vol.	1981 Δ %	1981 Share %	Average Δ %	Average Share %
U.S.A.	264.2	36.9	309.7	17.2	33.1	398.0	28.5	34.2	301.2	-24.3	36.0	256.5	-14.8	42.2	1.7	36.5
Singapore	292.1	40.8	397.2	36.0	42.4	447.4	12.6	38.4	286.7	-35.9	34.3	151.6	-47.1	25.0	-8.5	36.2
Soviet Union	41.7	5.8	48.6	16.5	5.2	72.8	49.8	6.2	67.2	-7.7	8.1	5.9	-91.2	1.0	-8.2	5.2
Japan	22.4	3.1	33.6	50.0	3.6	43.6	48.8	3.7	31.0	-28.9	3.7	20.1	-35.2	3.3	8.7	3.5
West Germany	16.1	2.2	29.3	83.0	3.1	40.2	37.2	3.5	20.7	-48.5	2.5	28.9	37.6	4.8	27.6	3.2
Others	80.0	11.2	118.4	48.0	12.6	163.3	37.9	14.0	129.0	-21.0	15.4	144.2	11.8	23.7	19.2	15.4
Total	716.5	100.0	936.8	30.7	100.0	1,165.3	24.4	100.0	835.8	-28.3	100.0	607.2	-27.4	100.0	-0.2	100.0

Source: Central Bureau of Statistics, Export Statistics.

Indonesia imports small quantities of rubber for its domestic needs (Table V.7). These imports consist mainly of synthetic rubber (43 per cent) and finished goods (32 per cent). Rubber imports have been growing recently at 12 per cent per year. Table V.8 presents statistics of apparent domestic consumption. The sharp fluctuations from year to year clearly reflect stock changes. The growth in domestic demand for natural and synthetic rubber reflects increasing processing capacity in Indonesia for tyres, inner tubes, household goods and office supplies, among others.

Table V.7: Volume of rubber imports by kind, 1978-1982
('000 tons)

Kind of Rubber	1978 Vol.	1978 Share %	1979 Vol.	1979 Δ %	1979 Share %	1980 Vol.	1980 Δ %	1980 Share %	1981 Vol.	1981 Δ %	1981 Share %	1981 Vol.	1981 Δ %	1981 Share %	Average Δ %	Average Share %
Natural Rubber	1.2	4.5	1.2	-	3.8	2.0	66.7	4.7	2.5	25.0	5.3	0.5	-80.0	1.3	2.9	3.9
Synthetic Rubber	11.5	43.2	14.6	27.0	45.6	16.2	11.0	37.8	20.7	27.8	43.6	18.4	-11.1	46.0	13.7	43.3
Finished goods	9.1	34.2	10.2	12.1	31.9	14.6	43.1	34.0	14.5	-0.7	30.5	12.4	-14.5	31.0	10.0	32.2
Others	4.8	18.1	6.0	25.0	18.7	10.1	68.3	23.5	9.8	-3.0	20.6	8.7	-11.2	21.7	19.8	20.5
Total	26.6	100.0	32.0	20.3	100.0	42.9	34.1	100.0	47.5	10.7	100.0	4.0	-15.8	100.0	12.3	100.0

Source: Central Bureau of Statistics, Import Statistics.

Table V.8: Apparent domestic consumption of rubber, 1978-1982[a/]
(000 tons)

Year	Production	Imports	Exports	Apparent Consumption[a/]	%
1978	885.0	26.6	861.5	50.1	-
1979	964.0	32.0	861.0	135.0	169.5
1980	989.4	42.9	976.1	56.2	-58.4
1981	963.3	47.5	812.7	198.0	252.3
1982	861.0	40.0	801.4	99.6	-49.7
Average	-	-	-	107.8	78.4

Source: Directorate General of Estates, Central Bureau of Statistics, Export and Import Statistics.

a/ Apparent consumption = Production + Imports - Exports.

5.1.2 Future prospects

The area under rubber trees has grown in recent years at an average annual rate of 1.7 per cent. Together with the replanting programme and improvement of yields, the expansion of area under rubber should result in a considerable increase in output by 1988 (Table V.9). The Repelita IV target for 1988 is 1.5 million tons. If the world market expands as projected (1983: 3.6, 1985: 5.7 million tons) prospects for Indonesian rubber exports are favourable. Assuming continuation of present trend of imports, domestic absorption will be about 61,000 tons in 1984 and 86,000 tons in 1988.

The projections provided by the Directorate-General of Estates and presented in Table V.9 may not yet fully take into account planned production under the nucleus estates programme. During Repelita III, an average of 60,000 ha per year was planted under this programme. During Repelita IV, the planting target is 120,000 ha per year. Production from these newly planted trees will begin within 6 years. At an average yield of 1 ton of dry rubber per year per hectare, the first 60,000 tons are expected to be available in 1984, rising to 120,000 tons in 1990.

Table V.9: Production, exports and consumption of natural rubber, projections 1984-88
('000 tons)

Year	Production	Exports		Consumption
		Volume	Percentage Increase	
1984	1,107	1,022	-	85
1985	1,150	1,057	3.6	93
1986	1,226	1,124	6.4	101
1987	1,350	1,240	10.3	109
1988	1,515	1,397	12.7	118

Source: Directorate General of Estates.

5.2 Processing

5.2.1 Processing Technology

Primary processing. The natural latex obtained by tapping rubber trees consists of water (60-66 per cent), rubber hydrocarbons (30-36 per cent) and minor constituents. (The composition of the latex is affected marginally by type of soil, quality of cone and season of the year.) The rubber is present in the form of discrete micro particles. Fresh latex, flowing from the tree, is almost neutral but tends to coagulate, as enzymatic and bacterial action increases its acidity. For this reason preservatives (expecially ammonia) and bactericides are added as soon as possible after tapping.

The latex is usually stabilised and concentrated before being exported. In order to reduce transport costs, and for easier use, most latex is sold as either centrifugated or creamed latex. The former is produced by treating the fresh latex with a stabilising agent (mainly ammonia, 0.3 per cent) and then passing it through a centrifuge where 80-85 per cent of solids content remains in the concentrate. After centrifugation, the ammonia content is readjusted (0.6 per cent) to ensure good storage. To produce creamed latex, the latex, after desludging (allowing it to remain in an unstirred condition for several days), is treated by adding creaming agents (mainly sodium or ammonium salts). It is then allowed to stand again while it separates in two layers. After the removal of the skin, the concentrate is again agitated, and a second separation takes place. Ammonia is added to the remaining concentrate which is then ready for shipping.

Secondary processing. In the traditional technology which yields slab or smoked sheet, the latex is coagulated in long tanks with removable plates across the width of the tank. The dilute fresh latex is poured into the tank where dilute formic acid is stirred in and the divider plates inserted. After about sixteen hours, the slags of coagulum are removed and passed through smooth moving rolls. The sheets are then allowed to hang, first for a few hours in open air and then for 3-5 days in a drying shed or smoke house where the temperature is regulated at 50-60°C. Historically, wood has been the fuel for drying rubber, and the smoke was thought to have a positive effect. After drying and grading into six different qualities, the smoked sheets are laid up into bales, and squeezed into standard size.

Crumb rubber is a method designed to process smallholder rubber into a product of better and more uniform quality. The latex is first strained through a sieve made of perforated plate in order to remove impurities such as leaves, bark and dirt, and then diluted with water, so that non-strainable materials such as sand and sludge are allowed to settle. The next step is chemical coagulation, often with the addition of white colouring matter. The rubber is then crumbed in a machine with rotary knives or a pelletiser, then washed, dried, sorted by quality (dirt content being the main criterion), and packed. In practice, the quality of crumb rubber has proved to depend greatly on the quality of coagulum delivered by smallholders.

Crepe rubber is a product of high quality, and requires high quality latex. It is processed from latex after refining and determining the dry rubber content. Before coagulation, a retarder is added to inhibit discoloration and softening. After coagulation, the substance is passed through a creping machine which consists of two rollers with longitudinal grooves. A shearing and masticating action takes place, exposing new surfaces to washing as water is sprayed over it. Several such machines are used in sequence, sometimes with a smooth rolling machine as the last step in order to get a more uniform surface. The sheets are dried in a shed for five to seven days. The crepe sheets are then sorted in different qualities (white, pale, brown, thin brown, etc.) and packed.

Powdered rubber. This processing technique has not yet been used in Indonesia but it has high potential because of its advantages for further processing. It is therefore briefly described here.

The powdered rubber is a free-flowing granular form of natural rubber with particle size ranging from 1 to 12 mm in diameter. Powdered rubber can be produced by spray-drying latex or by granulating crumb rubber bales. (The uses of powdered rubber produced by spray-drying are limited, mainly to the preparation of rubber solutions for adhesives. This process is used in Malaysia). Powdered rubber has the advantages of simpler handling in factories and saving of energy and labour in mixing and compounding. The powdered rubber and the compounding ingredients can be metered into powder mixers and continuously fed to the hoppers of extruders and injection moulding machines. Although at present the use of powdered rubber (mostly synthetic) is quite small (about 1-2 per cent of total use), there is considerable potential for this intermediate product which is ideally suited for automatic processing. The disadvantage of powdered rubber is its low density (one-eighth of that of based rubber) with consequent high storage and transport costs. It is therefore unsuitable for export.

5.2.2 Processing equipment (N.A.)

5.2.3 The processing industry

From 1968 onwards, the Government of Indonesia made determined efforts to rehabilitate the rubber industry which had fallen into serious decline and to upgrade the quality of smallholder rubber for export. After various unsuccessful attempts, a major initiative was directed at the development of crumb rubber as the means of redirecting processing from Singapore to Indonesia and of producing a product of uniform, internationally marketable quality.[1/]

In the 1970s, the export of low quality smoked sheet and slab having been banned, some 150 crumb rubber plants were established, mainly by private enterprise. As a result, however, demand for the raw material outran supply, and competition among processors resulted in deterioration in the average quality of coagula delivered to the factories. Considerable excess capacity developed, leading to bankruptcy by many firms and a runnng down of installed capacity.

At present, approximately 100 companies are engaged in crumb rubber production. Installed capacity has declined from about 950,000 tons in the late 1970s to about 700,000 tons in recent years. Production in 1982 was only 580,000 tons, implying a capacity utilisation of only 56 per cent. The condition of equipment is not known, so that effective spare capacity cannot be determined. In 1980, the crumb rubber industry employed 13,000 people.

No corresponding data are available on the rest of the Indonesian rubber processing industry most of which still consists of smallholders and small-scale enterprises producing smoked sheet, slab and other traditional products.

Some information is available on the rubber manufacturing industry (ISIC 355) which produces intermediate or finished rubber products. According to this, there were in 1974-75 in total some 450 establishments, of which 115 were government owned, 302 domestic private and the remaining 35 foreign. Total value added was Rp. 38.2 thousand million. The total number of

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[1/] See Bulletin of Indonesian Economic Studies, November 1972 and July 1982.

employees was 46,300, of whom 21,600 were in Java and 24,800 on the other islands. The number of establishments rose by 166 during the period 1970-80, employment by 31,250. The industry's share in total manufacturing value added rose from 1.3 per cent in 1971 to 4.8 per cent in 1980.

5.3 Equipment production

Most of the simple equipment, such as tanks, for the traditional methods of rubber processing into smoked sheet and slab is locally produced by traditional methods. It is uncertain whether they give rise to demand for modern manufacturing facilities, or might require technological improvements.

The main equipment for concentrated (centrifuged) latex production is the centrifuge; tanks and packing equipment are also required. The centrifuges have usually been imported from Germany. In view of the technological compexity of these machines, and the declining demand for the product, domestic production is unlikely.

The main categories of equipment used in the crumb rubber process are shredders, washing tanks, conveyors, driers and compactors. Most of this equipment is fairly simple and there are manufacturers in Indonesia, but in recent tenders they have been uncompetitive with Malaysian firms. The spare parts also are mostly imported, although hammer, knives, rollers and some other components are made locally. If the data on installed capacity and utilisation obtained during field work are correct, increased production could hardly be obtained by higher capacity utilisation, and will require new capacity. If the additional production of 68,000 tons of natural rubber in 1984 and 37,000 tons in 1985 (and so on for later years) is going to be derived from new areas distant from the existing crumb rubber plants, additional new capacity will be required. More precise information is needed to confirm this.

In conjunction with the nucleus estates programme, the Government is planning to develop processing near the estates. Average plant size of planned crumb rubber factories is 20 tons/day or 6,000 tons/year. This implies that 10 new crumb rubber plants per year will be required during Repelita IV.

The equipment of the existing crumb rubber industry is now on average 10 years old. Replacement demand will therefore increase strongly in the near future. Assuming annual replacement demand equal to 10 per cent of installed capacity, the need will be for 12 plants of 6,000 tons/year capacity. Total annual required investment demand will therefore be for 22 crumb rubber plants. There will also be a requirement for spare parts, especially rollers, for NES (Nucleus Estate and Smallholder scheme) rubber processing. This is estimated at 50 cast iron rollers per week or 2,600 per year.

The machines required for crepe rubber production are shredders, tanks, creping machines, driers and compactors. These require medium-size steel castings and considerable machinery, tooling and patterns investment. Here again, demand for the limited number of new units to be installed in Indonesia is unlikely to warrant domestic manufacture. This is the kind of machinery, however, for which the possibility of manufacture for the regional market under ASEAN complementation arrangements may be worth investigating. Driers involve mere fabrication and can be economically manufactured in small quantities. At a later stage, if and when demand expands, domestic manufacture of shredders and crepe mills, with later design models, may be considered.

The new technology of powder rubber processing may prove to be of value to Indonesia for local production of rubber products and deserves preliminary study.

5.4 Investment implications (N.A)

5.5 Recommendations

A crumb rubber factory of 6,000 tons/year capacity involves investment in machinery and equipment of about US$ 600,000. The estimated demand for crumb rubber factories therefore implies an investment requirement of the order of US$ 13.2 million per year. It is estimated that 75 per cent of this can technically be produced locally, or in round figures US$ 10 million per annum. Production of rollers, at US$ 1.00 per kg of cast iron, amounts to US$ 2.6 million of annual demand. Since a good deal of manufacturing capacity is already installed in Indonesia, it is estimated that US$ 5 million of investment in additional capacity will suffice to produce the crumb rubber equipment and rollers. Of this, US$ 1.5 million is accounted for by foundries to produce the rollers. Some 600 new jobs would be created in the equipment and replacement production units.

Two further planning efforts are recommended: first, a general screening study to establish exact data on capacity installed and utilised and investment requirements for replacement of old machinery as well as new capacity for the various kinds of rubber processing. If plans currently under consideration to upgrade quality by requiring smallholders to deliver unsmoked sheet to the crumb rubber plants are realised, mechanical equipment of the factories may need to be adjusted to the differen raw material. A GEC approach may well be the most suitable way of handing these tasks. Secondly, preliminary study of powdered rubber processing for local manufacture of rubber products.

Since the ASEAN countries between them account for a very large proportion of world rubber products, rubber processing euqipment of various kinds should be a prime candidate for intra-ASEAN industrial complementation arrangements. Production for the wider regional market should certainly improve the prospects for economic viability of equipment production industry.

Chapter VI Sugar processing equipment

6.1 Cane sugar production

6.1.1 The present situation

Although sugar consumption grew by almost 50 per cent between 1976 and 1981, on by about 8.5 per cent per annum (Table VI.1), per capita sugar consumption in Indonesia remains with 14.9 kg/capita among the lowest among the ASEAN countries. Thailand stands at 13.6, while it has reached 25.2 in the Philippines, 36.4 in Malaysia and 50.4 in Singapore (1980).

Sugar production grew from 1.3 million tons in 1976 to 1.9 million in 1981, an average by 8 per cent per annum, however, it could not match the increase in consumption. Preliminary figures for 1983 indicate likewise a production of 1.9 million tons. Imports doubled between 1976 and 1980 from 202,000 to 400,000 tons. Taking variations in stock into consideration, net consumption stood at 81 per cent in 1981. The value of sugar imports rose from US $108 million in 1976 to US $161 million in 1980 and US $573 million in 1981.

Table VI.1: Sugar consumption in Indonesia, 1976-1981
('000 ton)

Year	Consumption	Production	Import	Commencing Stock	Latest Stock
1976	1,600.4	1,318.4	202.2	327.3	247.5
1977	1,656.0	1,360.4	222.8	247.5	174.7
1978	1,816.7	1,497.0	430.8	174.7	285.8
1979	1,948.4	1,828.5	294.2	285.8	460.1
1980	2,474.9	1,831.7	399.7	460.1	216.6
1981	2,353.6	1,913.3	720.9	216.6	497.2

Source: Directorate General of Estates; Central Bureau of Statistics, Economic Indicators, December 1981. Quoted from: Bank Bumi Daya, March 1983.

Note: Consumption = Production + Import + (Commencing Stock - Latest Stock) - Exports.

The increase in domestic production originate mainly on smallholdings (Table VI.2). While the large plantations increased their production by only about 53,000 tons, the smallholders raised theirs by approximately 54,000 tons from 1976 to 1981 and produced in 1981 three times as much as in 1976. In the same time span they achieved an increase in yield per ha by 12 per cent against a drop of 26 per cent on the large plantations (private plantations: 45 per cent, state owned plantations: 24 per cent). Yet yield per hectare of the large plantations is still twice as high as on the smallholdings. The area under cultivation is shown in Table VI.3.

Table VI.2: Sugar production in Indonesia, 1976-1981
('000 tons)

Year	Plantations			Smallholdings	Total
	PNP/PTP	Private	Total		
1976	900	152	1,052	267	1,318
1977	924	23	1,007	353	1,360
1978	941	71	1,012	485	1,497
1979	1,012	81	1,093	736	1,828
1980	968	114	1,083	749	1,832
1981	988	116	1,104	809	1,913

Source: Directorate General of Estates.
Quoted from: Bank Bumi Daya, March 1983.

Table VI.3: Extent of sugar plantation area, 1976-1981
(in ha)
('000 tons)

Year	Plantations			Smallholdings	Total
	PNP/PTP	Private	Total		
1976	96	21	117	92	209
1977	100	16	116	118	234
1978	121	24	146	102	248
1979	126	26	152	192	343
1980	130	26	155	207	362
1981	139	29	168	244	412

Source: Directorate General of Plantation.
Quoted from: Bank Bumi Daya, March 1983.

Indonesia also produces brown sugar, at an estimated rate of 350,000 - 400,000 tons per annum, and an unspecified amount of sugar from the coconut and aren palms, mostly on a subsistence basis. It is not clear whether these quantities are included in the official statistics for production and consumption in Table VI.1.

6.1.2 Future prospects

Sugar consumption in Indonesia is expected to grow during Repelita IV at a somewhat slower rate than during Repelita III, i.e. at 7.2 per cent per annum. The Government hopes to replace all sugar imports and regain a net export position by 1985; the export quota granted to Indonesia by the International Sugar Conference of 1983 is 70,000 tons per annum. To meet these output targets, a substantial estate extension programme is under way, coupled with construction of new sugar mills, both on the outer islands. Besides extension of area under cane, it is hoped to achieve a steady increase in yields, from 4.65 tons of sugar per ha in 1981 to 6.76 tons in 1988, mainly through improved cultivation and harvesting methods, better seeds and improved juice extraction in the mills. These plans do not include brown sugar production most of which remains on a subsistence basis.

The Repelita IV targets for expansion of area under cultivation and for white sugar production are shown in Table VI.4. It is not clear what accounts for the differences in production and consumption figures between Tables VI.1 and VI.4.

Table VI.4: Projected extension of sugar plantations and sugar production during Repelita IV, 1984-1988

	1984	1985	1986	1987	1988
Area under sugar cultivation					
(000 ha)	277.6	332.3	357.3	367.3	377.3
(Java)	(231.0)	(259.2)	(259.2)	(259.2)	(259.2)
(outside Java)	(46.6)	(73.1)	(98.1)	(108.1)	(118.1)
Production of sugar					
(000 tons)	1,759	2,156	2,331	2,449	2,550
(Java)	(1,569)	(1,814)	(1,814)	(1,814)	(1,814)
(outside Java)	(190)	(342)	(517)	(645)	(736)

Source: Indonesian Sugar Council Secretariat and Economi Indonesia, No. 71, Vol. XIV.

6.2 Processing: sugar mills

There were, in 1983, 58 sugar factories in Indonesia, including 51 government-owned and seven privately owned. The great majority (55) were on Java, only three outside Java (one each in Aceh, Lampung and South Sulawesi). The one in Lampung is a foreign investment enterprise, with a capacity of 4,000 tons of cane per day (TCD) and an output of 80,000 tons of sugar per annum. Since the middle of the past decade, factory rehabilitation has been under way, financed by a World Bank loan of US $50 million to rehabilitate 25 mills. The first stage of this programme is near completion and the second stage is reported two-thirds complete.

Repelita IV targets envisage an increase in production in 1985 over 1984 of nearly 400,000 TCD, of about 175,000 in 1986, 120,000 tons in 1987 and 1988. In other words, some 800,000 tons additional sugar processing capacity will need to be established during Repelita IV. Assuming a standard mill capacity of 4,000 TCD, corresponding to about 76-80,000 tons of sugar per year, this means that twelve new sugar mills will be needed.

The Government in fact plans to build twelve new mills of which six were already under construction in 1983 and one more has been commissioned. All but one of these is on the outer islands, located as follows: four in Sulawesi, two in Lampung, three in North Sumatra and one each in South Kalimantan, Buru Island and West Java. In August 1983, the Investment Coordinating Board announced three projects open for private investment with proposed locations in Kolaka (South Sulawesi), Wolawa (Southeast Sulawesi) and Merauke (Irian Jaya). The capacity of these mills may diverge from the standard 4,000 TCD on which the calculated number of required mills was based, but they are more likely to be larger than smaller. Together with rehabilitation currently under way, these extensions of capacity should suffice to meet future demand and leave a margin for reserve stock increases. From 1988 onwards, an average of two sugar mills every three years will have to be commissioned to meet projected demand.

6.3 Equipment production

The seven sugar factories put up for tender in Repelita III were commissioned on the condition that (a) the international equipment supplier cooperate with a domestic engineering and equipment manufacturing company and (b) that a local content of approximately sixty per cent be achieved. These conditions have been fulfilled.

Six companies (three state-owned and three private) are engaged in engineering planning of sugar mills and are producing various kinds of equipment. In the past year or two, they have also begun manufacture, partly under licensing agreements, of more complex machinery, such as centrifuges. One company, with a licensing agreement with a German manufacturer, has already produced forty centrifuges with a local content of about sixty per cent. Another centrifuge producer has a license agreement with an American company. For the next sugar mills to be commissioned, the main contractor is to be an Indonesian company supported by an internationally known sub-contractor. During the next phase of sugar mill construction, a local content, according to estimates by international suppliers, of 70 per cent should be attainable.

A wide range of spare parts is also produced domestically, partly by the often well equipped repair shops of the sugar mills themselves.

6.4 Investment implications

By 1988, five additional sugar factories have to be installed, i.e. one mill per year. At an average price of US $40 million for equipment per plant, this represents an investment volume of US $200 million. If seventy per cent can be produced locally, investment of US $140 million, or US $28 annually will be needed. The capacity for local production of the bulk of this portion of the equipment already exists, but for special components an amount estimated at twenty per cent of total investment (i.e. US $30 million or US $6 million a year) will also have to be invested in the equipment producing industry.

Besides this new investment, there will be a continuing investment requirement for rehabilitation and replacement, estimated at US $1.5 million for each 100,000 tons per annum of sugar production capacity installed. This gives an average figure of US $35 million per year for Repelita IV. The same amount will have to be budgeted for spare parts. Here again, it is assumed that 70 per cent, or about US $25 million per annum, can be manufactured locally.

Thus, one reaches the following totals for technically possible local production of sugar mill machinery and equipment during Repelita IV:

	US $ million per year
- investment in new capacity	28
- replacement of outdated equipment	25
- spare parts	25
TOTAL	78

The requisite productive capacity in the main already exists. But it is estimated that US $10 million a year will be required for new capacity to produce special components (US $6 million) and for replacements (US $4 million). This gives a total investment requirement of US $50 million for the five year period.

6.5 Recommendations

The procedure for increasing local content which has been adopted for equipment production in the sugar industry may serve as an example for other sectors. It is applicable to sectors where turnkey operations are common because technical requirements demand the establishment of whole plants as integrated units. Especially the procedure of switching the local engineering company from the role of an affiliate to that of main contractor with a foreign affiliate may well be appropriate for a number of sectors.

The next phases of sugar equipment manufacture are likely to include efforts to raise local content, especially for sub-contracted components, such as pumps, motors and speed reduction gears, and for the more sophisticated equipment through knowhow agreements with foreign partners.

Chapter VII Processing equipment for estate crops: cocoa, coffee, and tea

7.1 Estate crop production:

7.1.1 The present situation

Cocoa: Indonesia has not hitherto been a significant producer of cocoa. Production increased from 5,500 tons in 1978 to 15,000 tons in 1981, but even the latter figure represented less than one per cent of world production.

Cocoa is produced mainly in East and Central Java, North Sumatra, South Sulawesi and Maluku. Government estates still account for most of the output, but private estates have made an increasing contribution to a threefold increase in output during 1978-81, promoted by a programme of rejuvenation and extension of estates, as well as improved pest and disease control, use of fertiliser and cultivation (Table VII.1). Since cocoa trees take seven years to bear fruit, output can be expected to grow substantially during the 1980s in response to extensive recent planting.

Table VII.1: Cocoa production by type of estates, 1978-1982
('000 tons)

Year	Government Estates	Private Estates	Smallholdings	Total
1978	4.3	0.2	1.0	5.5
1979	7.4	0.7	1.0	9.2
1980	8.4	0.8	1.1	10.3
1981a/	10.4	1.3	1.5	13.1
1982a/	12.2	1.3	1.5	15.0

Source: Directorate General for Estates.
a/ Provisional figures.

Indonesia's exports of cocoa, mainly to Singapore, increased substantially in volume in recent years (Table VII.2), but a fall in world market prices by one-third during 1978-81 largely offset this gain. More than 90 per cent of exports consists of beans, powder and paste (Table VII.3). Quality requirements are fixed according to International Cocoa Standards. Indonesia also imports cocoa, mainly in the form of beans, presumably to make possible appropriate quality blending (Table VII.4).

Table VII.2: Cocoa exports by value and volume 1978-1982

	1978	1979	1980	1981	1982a/
Volume (000 tons)	6.22	8.63	14.97	17.51	10.49
Per cent increase to previous year	-	38.7	73.5	17.0	-
Value (000 US $)	14.65	22.14	29.76	31.10	16.50
Per cent increase to previous year	-	51.1	34.4	4.5	-

Source: Central Bureau of Statistics, Export Statistics, 1979-82.
a/ Up to June.

Table VII.3: Cocoa exports by type of cocoa, 1978-1982
('000 tons)

	1978		1979		1980		1981		1982a/	
	Vol.	Share%	Vol.	Share%	Vol.	Share%	Vol.	Share%	Vol.	Share%
Beans	2.2	36.1	3.6	42.2	4.7	31.3	6.8	38.8	4.1	39.5
Powder	2.0	32.3	2.4	27.5	9.4	62.7	2.3	13.0	1.5	13.8
Paste	1.0	16.4	2.0	23.2	40.0	0.3	5.8	33.0	3.6	34.2
Butter	0.9	14.0	0.6	6.8	0.9	5.7	1.9	10.9	1.0	9.2
Others	0.1	1.2	25.0	0.3	-	-	0.8	4.5	0.4	3.2
Total	6.2	100.0	8.6	100.0	15.0	100.0	17.5	100.0	10.5	100.0

Source: Central Bureau of Statistics, Exports Statistics 1979-1982.
a/ Up to June.

Table VII.4: Domestic consumption of cocoa, 1978-1981
(000 tons)

Year	Production	Imports	Exports	Apparent Consumptiona/	Annual Growth Rate
1978	5.5	2.1	6.2	1.5	-
1979	9.2	2.9	8.6	3.4	132.3
1980	10.3	8.3	15.0	3.6	6.6
1981	13.1	9.2	17.5	4.8	33.9

Source: Directorate General of Estates and Central Bureau of Statistics.
a/ Apparent consumption = production + imports - exports.

Coffee: Indonesia occupies fourth place (after Brazil, Colombia and the Ivory Coast) among the world's 47 coffee producing countries. Indonesia ranks second (after the Ivory Coast) as a producer of robusta and accounts for nearly 15 per cent of world robusta production. More than 85 per cent of Indonesia's coffee is robusta, less than 15 per cent arabica. As Table VII.5 shows, coffee is mainly a smallholder crop.

Table VII.5: Coffee Production, 1975-1981
('000 tons)

	1975	1976	1977	1978	1979	1980	1981
Smallholdings	144	178	181	206	209	213	276
Estates	16	16	16	17	19	21	23
Total	160	194	197	223	228	234	299

Source: EIU Quarterly Economic Review of Indonesia, Annual Supplement, 1983.

Most of Indonesia's coffee is exported. Coffee is Indonesia's third largest non-oil export commodity, after timber and rubber. The destruction of much of Brazil's coffee crop by frost in 1975, and shortfalls in supply from Africa, caused a steep rise in world coffee prices which greatly benefited Indonesia and stimulated coffee production. Exports reached US $614.3 million in 1979 and US $656 million in 1980 (Table VII.6). Prices then declined, and Indonesia's coffee exports fell by nearly 50 per cent in 1981 to US $345.9 million. Oversupply on world markets, aggravated by worldwide economic recession, was responsible. Indonesia's availability of coffee normally exceeds its annual fixed quota. The non-quota coffee is mainly exported to Arabian countries.

Table VII.6: Coffee exports, 1975-1981

	1975	1976	1977	1978	1979	1980	1981
Volume ('000 tons)	128	136	160	215	220	238	210
Value (US$ million)	100	238	599	491	614	656	345

Source: Economic Review, Bank Negara Indonesia.

Tea: Most of Indonesia's tea is grown at a height of 1,035-1,550 m., in rather acid soils which are optimal for plant nutrition. Estates whose output is mostly processed to black tea for export have increasingly replaced smallholders and now account for around four-fifths of total production; the share of smallholders who produce mainly green tea for domestic consumption has fallen to one-fifth (Table VII.7). Most of the estates are state enterprises of about 1,000-1,500 ha producing 1,000-1,500 tons per year each.

Table VII.7: Growth of Indonesian tea production, 1974-1981
(000 tons)

	Plantation	Smallholdings	Total
1974	51	14	65
1975	56	14	70
1976	60	13	73
1977	62	14	76
1978	74	17	91
1979	108	17	125
1980	84	18	112
1981	85	22	107

Source: Indonesian Financial Statistics, Bank Indonesia, February 1979.

The average yield of tea per 1,000 ha for estates and smallholders combined was about 720 metric tons in 1977, as compared with 1,540 tons/1,000 ha in India and 880 tons/1,000 ha in Sri Lanka in the same year.

Indonesia ranks fourth among tea exporting countries (1978), but tea contributes less than 3 per cent of non-oil export earnings, and a significantly higher proportion of tea than of coffee (29 per cent as compared with about 15 per cent) is for domestic consumption. Tea exports benefited from the world coffee shortage in the mid-1970s, but prices fell somewhat in the following years. In 1982, earnings rose again (Table VII.8).

Table VII.8: Growth of Indonesian tea exports, 1974-1978

Year	Volume ('000 ton)	Value (US $ million)
1974	55.7	43.6
1975	45.9	53.1
1976	47.5	56.0
1977	51.3	120.9
1978	56.1	94.6
1979	68.0	92.0
1980	n.a.	n.a.
1981	n.a.	n.a.
1982	73.5	116.0

Source: Weekly Report, Bank Indonesia, No. 1040, April 1979; Economic Indicators, January 1979, Central Bureau of Statistics.

7.1.2 Future prospects

Cocoa: During Repelita IV many of the new cocoa plantations will start bearing. Repelita IV target figures for cocoa production indicate a very high rate of growth, about 10,000 tons a year after the first year (1984). This would raise output nearly fourfold by 1988. Up to 94 per cent of output is planned for export (Table VII.9) which implies that a substantial volume of cocoa will continue to be imported.

Table VII.9: Projections of cocoa production and exports, 1984-1988
(000 tons)

	1984	1985	1986	1987	1988
Production	15.7	24.9	35.5	45.4	56.3
Export	12.6	21.8	32.3	42.1	53.0
Share for domestic consumption a/	3.1	3.1	3.2	3.3	3.3

Source: Directorate General of Estates.

a/ Excluding imports.

Coffee: Repelita IV projections for coffee production and export are given in Table VII.10. The target increase in coffee production is 10,000 tons a year over the four years 1984-88, giving a total increase of around 40,000 during Repelita IV. Broadly constant proportions are expected to be exported (75 per cent) and consumed at home (25 per cent).

Table VII.10: Projection of Coffee Production and Exports, 1984-1988
(000 tons)

	1984	1985	1986	1987	1988
Production	309	318	328	338	348
Export	232	239	247	256	264
Domestic consumption	77	79	81	82	84

Source: Directorate General of Estates.

Tea: About 2,300 ha of new estates and 15,000 ha rehabilitation are planned for Repelita IV. The projected production of tea over the period 1984-88 is shown in Table VII.11. The projected growth rate is the lowest of the three crops considered here and amounts to 17,000 tons during Repelita IV.

Table VII.11: Projected Production and Exports of Tea, 1984-1988
('000 tons)

	1984	1985	1986	1987	1988
Production	116	119	122	126	130
Export	77	79	82	85	88

Source: Directorate General of Estates.

7.2 Processing

Cocoa: Cocoa bean processing begins with fermentation. The wet beans are fermented in wooden vats to remove the pulp. The process is carried out in a series of fermentation troughs or vats for period of 12, 24, 25, 20 and 5 hours in succession. The beans are then conveyed by a screw conveyor through a small open channel to a washing pool. The washed beans are first sun dried for six to nine hours and then dried in tray driers for a period of 18 hours in all, at different temperatures. Four tons of wet beans give 1.25 tons of dry beans ready for export.

A typical processing unit handles about 350 ha of plantation, produces about 500 tons of dry beans ready for export and employs about 60 persons.

The processing of cocoa beans requires the following equipment:

1. Flight conveyers, for en masse transportation of the fermented wet beans.
2. Tray driers, with oil-fired heater and fan unit, for drying the wet beans, or rotary driers, with similar heating and air blowing equipment.
3. Cocoa bean grader.

A typical unit producing about 500 tons of dry beans a year requires 1 conveyor, 4 tray driers and 2 graders. The total cost of the equipment per unit in about Rp. 200 million at current prices.

For chocolate and chocolate beverage production, the dry beans are further processed. The beans are ground, the ground powder is prepared into a meal, pressed in special processes to produce cocoa butter and cocoa cake, mostly for exports. There is a small volume of domestic manufacture of chocolate for which the equipment required consists of rather complex and specialised grinders, mixers and presses.

Coffee: Coffee processing involves curing, grading, roasting, blending, grinding and packaging.

- Curing: (removing the outer part of the fruit to leave the coffee bean) is done is one of two processes.

Under the wet method, the freshly picked cherries are fed into a tank for initial washing, in order to remove stones and other foreign materials. The washed cherries are then fed into a depulping machine to remove the outer skin and most of the pulp, thus freeing the beans. The beans are then poured into a fermentation tank, usually filled with water, in order to remove the remaining pulp. This process takes from twelve hours to several days. The beans are then dried in mechanical dryers. Parchment is broken by rollers and removed.

Under the dry method, which is used in countries where water is scarce during the harvesting season and in most of Brazil, the ripe cherries are spread on open drying ground, and turned frequently in order to allow the sun and the wind to dry all portions thoroughly. The dry cherries are then transferred to hulling machines for the removal of the husk, parchment and silver skin.

- Grading: The green beans are then machine graded into large, medium and small sizes by the use of sieves, oscillating tables or conveyors, removing also damaged beans and foreign matter. The criteria used in grading include imperfections, foreign matter content, colour and roasting characteristics, and, most important, cup quality of the beverage.

- Roasting: This develops the desired flavour which is absent in green coffee. The obvious modifications are changes in colour (from green to brown), and a large increase in volume (50-100 per cent). However, the physical and chemical changes that take place during roasting are complex and not completely established.

- Blending: After cleaning, green coffee of different varieties or sources are blended, either before or after roasting. Beans are then again sieved, by air lifting, from remaining foreign matter and conveyed to grinders.

- Grinding: The beans are first passed through bean cracking rolls, then fed between two more rolls, one of which is cut or scored longitudinally, whereas the other is cut or scored circumferentially. These paired rolls, operating at different speeds, cut rather than crush the bean particles. A second pair of rolls, scored more finely and running at higher speed, achieves a finer grind.

- Packaging: An important part of the coffee sold directly to consumers is packed in vacuum cans, although smaller amounts are packed in flexible bags, paper cartons, glass jars, or laminated flexible film and foil packages. For vacuum cans, the ground coffee is conveyed to weighing-and-filling machines. The can is filled with ground coffee by tapping or vibrating, and passes through the vacuum chamber to remove the air. Sometimes, the can is filled with gas such as nitrogen or carbon dioxide. Staling (loss of fresh character when exposed to air) is caused by the volatilisation of the more volatile constituents together with chemical reactions such as oxidation. It cannot be inhibited by antioxidants, but can be slowed at lower storage temperature or by vacuum packing.

- Equipment used: The following equipment is required for processing coffee beans (wet method):

1. De-pulper, for separating pulp and beans.
2. De-pulper cum washer, for separating beans and washing.
3. Pump with motor, for pumping wet parchment coffee or wet coffee cherries.
4. Rotary driers, for drying wet parchment.
5. Hullers, for treating dry parchment coffee, or dry cherries.
6. Catador, for separating husk peels and dust.
7. Vibrating grader, for bean size classification.

For a processing unit with 10,000 tons per annum capacity, the equipment required is four depulpers, four depulpers cum washers, one pump, four rotary driers, two hullers, two catadors and two graders. The total cost per processing unit is about US $500,000.

The equipment for roasting includes coffee roasters and sieves, for grinding bean cracking mills for coarse grinding and grinding mills for fine grinding. For instant coffee, the same equipment as above is used for blending, roasting and grinding; other equipment includes coffee extractors, clarifiers, spray driers and screens.

Tea: Processing of tea involves withering, rolling, fermentation, drying and grading.

- Withering: The freshly plucked shoots are dehydrated by passing air through loosely packed fresh leaves. This process lasts up to twenty hours. besides reduction of moisture which renders the leaves malleable, some chemical processes occur.

- Rolling: The purpose of this stage is to subject the withered leaf to a wringing action in a rolling machine.

- Fermenatation: This word is still retained by the tea industry to describe the operation of enzymatic oxydation and condensation of the flavanols. During this process, the colour changes from green through olive green to light brown. At optimal point, the fermentation is stopped by heat, exposing leaves to hot air (85-95°C) in a drier.

- Drying: In this operation, the leaf is carried through the drier on a series of metal trays, moving slowly. The leaves fall from one level to the other, until completely dried tea falls off the last tray and exits after about 15-30 minutes.

- Grading: Using sifting machines the dried leaf is sorted mechanically or by air flotation into various broken and powder grades and packed with a moisture content of around three per cent. Other qualities of tea, green tea (enzymatic oxydation being inhibited by steam shock) or instant tea may be found on the market.

The dry tea leaves can be separated from coarse to very fine. The types of dry tea are sorted into three groups, that is tea leaf, crushed tea and powdered tea. These three large groups can be further divided into several types.

- The equipment used for processing tea is:

1. Withering troughs with blowers
2. Rolling machines, rotary rollbreakers, rotorvane machines
3. Sorting machines, stalk extractors.
4. Driers, multistage
5. Graders, rotary tea sifters
6. Vibratory tea packers
7. Heat exchangers
8. Suction winnowers and dust collectors.

7.3 Equipment production

The equipment for cocoa bean processing is relatively simple and is produced locally.

Some of the equipment for coffee processing is also locally manufactured or assembled. But in general, the equipment at present used in the coffee bean processing units at the estates is of very old design and inefficient in operation (particularly the driers), leading to enormous consumption of fuel. The cost of drying equipment at present accounts for 65 per cent of total costs of processing equipment. Quality standards in respect of moisture content are stringent for exports, since export coffee has sometimes to be stored for considerable periods. Export prices depend on quality. A "defect system" for grading Indonesian coffee for export has been introduced. Quality variations have caused price differentials involving losses estimated at some US $40 million a year to Indonesia in the recent past.

In earlier years, most of the equipment for coffee processing was imported. At present, about 80-85 per cent of the machinery are reported to be made locally. But this is difficult to confirm. Much of it may consist primarily of assemly.

The production of tea processing equipment is carried on in several general workshops, in Bandung and elsewhere. In 1980, 27 units valued at Rp. 142.6 million were produced.

7.4 Investment implications

There are some similarities among the processing equipment for the three estate crops considered here, especially between cocoa and coffee. The rotary driers for coffee and cocoa are very similar in construction, and cocoa graders are similar to coffee bean graders. The demand for the cocoa processing equipment, added to that for coffee, tea and other similar equipment, could bring demand up to levels economic for domestic manufacture.

To process an additional 40,000 tons of cocoa beans requires about 80 units of 500 tons capacity each, over the period 1985-88, at the rate of about 20 units per year. This would result in an annual demand for equipment as follows:

20	flight conveyors
80	tray driers with heater and blowers
40	cocoa graders.

The approximate cost of equipment per unit is US $200,000, implying a total investment of US $4 million per year.

An additional amount of 40,000 tons of coffee has to be processed over the period 1985-88, assuming Repelita IV projections of output. This will require about four processing units of 10,000 tons annual capacity, valued at about US$ 2 million, or US $500,000 per year. In terms of numbers, this means about 16 rotary driers, 8 depulpers, 16 depulpers cum washers, 8 hullers, 8 catadors, 8 graders and about 4 pumps over the five year period 1984-88. (The processing units have a capacity of 80 tons of coffee beans per day, 24 working hours a day and 4 months a year, i.e. 10,000 tons of per annum.) Since the equipment at present installed is very old and inefficient, it is assumed that the same amount of machinery will be needed for replacement. This gives a total investment requirement of US $4 million, or US $1 million a year.

The equipment for tea processing such as the rolling machines and rotorvane machines for tea rolling, require good casting and machining facilities. The size of the castings would require medium to large size machine tools in turning and boring. The second group of machines such as vibratory sorters, sifters and graders are relatively simple equipment requiring sheet metal fabrication. The manufacture of multistage driers also does not demand any special facility.

It is assumed that the additional future tea production of 17,000 tons per annum will be produced by production increases of existing estates (6,000 tons per annum) and by new plantations (11,000 tons per annum). A typical tea processing unit has a capacity of approximately 2,700 tons per annum. This means that four new processing units, or one per year, will be required.

It is furthermore assumed that annually two processing units will be installed for replacement of old equipment.

One tea processing unit costs approximately US $650,000. This gives a total investment volume of US $8 million for the period considered or approximately US $2 million annually.

Summarising, the investment volume for the processing of the three crops is as follows:

-	cocoa:	US $16 million for 1985-1988 or US $4 million annually
-	coffee:	US $ 4 million for 1985-1988 or US $1 million annually
-	tea:	US $ 8 million for 1985-1988 or US $2 million annually
-	Total:	US $28 million for 1985-1988 or US $7 million annually.

All this equipment can "technically" be produced in Indonesia with a local content of about 80 per cent. The remaining 20 per cent consists of special components (bearings, electric motors, etc) which will have to be imported. The resulting production would be US $5.6 million per annum in value. The employment generated would be about 250 new jobs. Some of the capacity to produce this equipment is already installed in Indonesia. It is estimated that additional investment of about US $3 million will be needed to improve and enlarge equipment production capacity.

7.5 Recommendations

The technical capacity for domestic production of much processing equipment for cocoa, coffee and tea already exists in Indonesia. However, little is known about the capacity of the existing relatively small-scale equipment producing industry to produce economically and efficiently. It is therefore recommended that this sub-sector be further investigated to determine the strong and weak points of the existing industry. This should lead to recommendations concerning the strengthening of existing enterprises and the establishment of new plants, including requisite information about the additional investment, technology and manpower requirements.

Chapter VIII Wood Processing Equipment

8.1 Timber production

More than sixty per cent of Indonesia's land area is covered by tropical forest. The country's forestry potential is among the greatest in Asia but will in future need to expand its forest conservation and reafforestation activities to hold this position.

The total forest area of 122 million ha is officially classified as follows:

- according to exploitability
  - exploitable: 45 million ha (37 per cent)
  - potentially exploitable: 48 million ha (39 per cent)
  - others: 29 million ha (24 per cent)
- according to legal status
  - reserved: 47 million ha (38 per cent)
  - protected: 48 million ha (39 per cent)
  - unclassified: 28 million ha (23 per cent)

Such data on exploitable forest reserves, however, have to be treated with caution. In many countries there has in the past been serious overestimation which has led to excessive depletion. Some reserves are in remote and inaccessible areas and cannot be regarded as economically "exploitable" because of high transport costs. Exploitation of some forests in undesirable for environmental reasons, such as soil erosion (e.g. on steep slopes) or disappearance of the tree species.

At present, forest exploitation in Indonesia is concentrated in Kalimantan which accounts for more than 50 per cent of logging activity. Of the approximately 4,000 species of trees, 127 are commercially useful. The main species cut for export are Meranti (53 per cent), Ramin (15 per cent), Kapur (8 per cent), Agathis (3 per cent) and Pulai (2 per cent). Teak has a share of only 0.2 per cent.

During the 1960s and 1970s, forest exploitation in Indonesia expanded very rapidly, largely for export of logs to Japan, the Province of Taiwan, the Republic of Korea and elsewhere for plywood and other processing. In 1978, the Government of Indonesia decided to enforce increased domestic processing by, in effect, drastically and progressively restricting export of logs, with a view to banning it completely from 1985, and promoting domestic plywood production.

At present, under contracts with the Indonesian Government, timber concessionaires are obliged from the seventh year of operation onward to process locally 40 per cent of the Annual Allowable Cut (AAC) and export it in processed form. The result has been an investment boom in saw mills, veneer and plywood manufacturing. In some cases, production plants in the Republic of Korea, Japan and the Province of Taiwan which formerly depended on Indonesian logs as inputs, threatened with shutdown, have relocated in Indonesia. These policy changes have brought dramatic change in the volume and composition of Indonesian timber production and exports.

Table VIII.1. shows production of logs and sawn timber over the period 1976-81. After rising by 22 per cent in the first three years, log production dropped sharply by 37 per cent between 1979 and 1981. Table VIII.2 shows that the decline in log production largely echoed the decline in exports, chiefly of logs, although the world recession contributed to the fall in export earnings, in terms of both volume and price. There was a further decline in 1982.

Table VIII.1: Timber production, 1976-1981

Year	logs (m^3) (000 m^3)	Sawn timber (m^3) (000m^3)
1976	20,803	635
1977	22,335	605
1978	24,743	1,513
1979	25,314	1,637
1980	25,190	1,794
1981	15,954	2,658

Source: Forestry in Indonesia, 1983.

Table VIII.2: Exports of timber, 1976-1981

Year	Logs 1,000 m^3	Logs Mill. US$	Sawn timber 1,000 m^3	Sawn timber Mill. US$	Total 1,000 m^3	Total Mill.US$
1976	17,877	729.28	644	52.47	18,521	781.75
1977	19,212	900.97	594	50.30	19,806	961.27
1978	19,443	909.31	757	85.76	20,200	995.07
1979	18,205	1,551.33	1,284	245.33	19,489	1,796.66
1980	14,416	1,548.86	1,225	256.81	15,541	1,805.54
1981	6,201	579.29	1,171	188.64	7,372	767.93

Source: Forestry in Indonesia, 1983

8.2 Processing

The generally accepted technology in relation to the timber using industries distinguishes between "primary" processing which uses the log as the raw material (and thus includes not only saw milling, but also veneer, plywood and fibre board production) and "secondary" processing which uses an intermediate product, such as sawn timber or plywood, as raw material for the manufacture of wood products (building timber, furniture, wood carvings, etc.) and employs wood working machinery. Demand for wooden components of buildings is likely to become a major part of the market for the industry.

Processing Equipment:

There is no need for a detailed description of the various kinds of equipment used in saw milling and wood working with their relatively straightforward technology. Plywood production, however, requires a very wide range of partly quite sophisticated machinery.

Saw milling equipment can be classified in five main categories, viz. (band) saws, the log intake, the distribution system which transports sawn logs for further sawing, and the final transport and the sorting system.

1/ For a detailed description of the wood processing equipment, see UNIDO "Technical Criteria for the Selection of Wood Working Machines" UNIDO/ID/247.

Wood working equipment may be divided into equipment for machining and for assembly. In most cases, the minimum capacity for economic equipment production is relatively small (i.e. 100-200 wood working machines a year) if labour-intensive machining processes are employed.

The Processing Industry: The Present Situation

Saw milling. Following the Government decision to increase the value added of exports by coupling log export permits to the installation of wood processing units, local production of sawn timber, veneer and plywood increased considerably from 1979 on. Nominal capacity for sawn timber is about 8.1 million m^3 and of plywood 3.5 million m^3; working capacity is approximately 20 per cent less. Some of the saw mills in Kalimantan reach only 50 per cent use of their nominal capacity owing to outdated equipment (even though only recently installed). The enterprises also tend to report high installed capacities since this favourably influences their log export quota. Total capacity is divided among 175 enterprises with concessions and in operation, with an average daily capacity of 150 m^3 (Table VIII.3).

Table VIII.3: Saw mills - number, capacity, production and export 1979-1983 (in million m^3)

	1979		1980	1981		1982	1983	
	Number	Capacity	Capacity	Number	Capacity	Capacity	Number	Capacity
License request	44			100	2.8			
Under construction	15			27	0.8			
In operation	145			202	6.3		175	8.1
Production of sawn timber		4.0			7.3	8.4		
Export			1.2		1.3	1.4		

Source: BKPM (quoted by FGU Kronberg Unternehmensberatung).

Besides these establishments, there is a large number of hand saw mills with a daily output of 0.5 m^3 which are not registered, and a number of partly registered small enterprises with band saws and daily capacity of 10-30m^3. The majority of the new saw mills are installed in Kalimantan, followed by Sumatra and Sulawesi. Maluku and Irian Jaya are still of little importance.

At present, according to industry information, the investment cost in Indonesia of a 3-line saw mill is in the range of US$ 2 million for a capacity of 70,000 m^3 per annum, that is US$28.6 per m^3. This figure is relatively low and indicates that the operational quality of the machinery is low, with adverse effects on the quality of the sawn timber. There is now a trend towards improved end product quality in the Indonesian saw mill industry, since good quality finds buyers even in a fairly stagnant export market.

Plywood production. According to BKPM statistics, there were in 1983 investment applications for 105 plywood factories with a total capacity of 3.6 million m^3. In operation were 67 factories with a licensed capacity of 3.5 million m^3 and a production of 3.1 million m^3 (Table VIII.4). Capacity utilisation, according to the data in Table VIII.4, is running at 89 per cent; 81 per cent of production was exported. According to BPS statistics, there were in 1981 31 plywood factories in operation, employing 26,212 persons and having a gross value of output of Rp. 290 billion and value added of Rp. 130 million. According to the Directorate-General of Forestry, licences granted (including plants in operation) totalled 119 in May 1983. Of these, 68 were located in Kalimantan, 30 in Sumatra, 11 in Maluku, 5 in Java, 4 in Sulawesi and 1 in Irian Java.

Table VIII.4: Plywood factories - number, capacity, production and export (in million m^3)

	1979		1981		1983	
	Number	Capacity	Number	Capacity	Number	Capacity
License request	32	1.3	118	5.0	105	3.6
Under construction	6	0.3	20	0.9		
In operation	21	0.8	34	1.6	67	3.5
Production		0.6		1.1		3.1
Export		0.1		0.8		2.5

Source: BKPM (quoted by FGU Kronberg Unternehmensberatung).

The investment costs in machinery and equipment of plywood factories range from US \$80 to US \$480 per m^3, according to an analysis of 15 enterprises in Indonesia. The enormous range of these figures, by a factor of 6, precludes any firm conclusions. Internationally, one counts at present with investment costs of US \$200/m^3 for a 3-line plant producing high quality plywood.

Statistical data on wood products manufacture in Indonesia are very incomplete, with wide variations in data from different sources. The figures in Table VIII.5 are based upon Part II of this study.

Table VIII.5: Industrial establishments in wood products and wooden furniture

	Year	Wood products (except furniture)	Wooden Furniture
No. of establishments	1970	107	43
	1980	483	137
Employees (thousand)	1970	7.0	1.7
	1980	58.9	5.7
Value added (billion Rp.)	1970	1.9	0.4
	1980	149.1	4.26
Gross output (billion Rp.)	1970	2.3	0.4
	1980	37.7	8.8

Source: Part II Annex Tables 11 and 12.

Furniture and wood working is predominantly a small-scale industry, with an estimated 4,000 establishments. At most 10 per cent of the industry is mechanised, and at most 20 firms (a majority in the Pulo Gadung Industrial Estate, Jakarta) are engaged in serial production of furniture, joinery and wood work items. The other plants are concentrated in the urban centres in Java and Sumatra. Except for a very few firms in Java, product quality is still low and would hardly be acceptable in the international market. The industry sector is represented by the Indonesian Woodworks Manufactures Association, with head office in Jakarta.

The importance of the small industry sector can also be gauged by the remarkable increase in sales of small (workshop type) wood working machinery of up to US\$ 5,000 sales value in recent years. According to information supplied by importers, imports of these machines rose from 250-400 pieces in 1975 to more than 10,000 pieces in 1982/83, before the rupiah devaluation of

March 1983 (Table VIII.6). Most of the imports have been from Japan and Germany.

Table VIII.6: Market data on woodworking machinery

Product	Order of sales price in Indonesia US$	Estimated annual sales (1982/83) (pieces per year)
Bandsaws (0 800m)	2,000-3,000	5,000
Heavy duty circular table saws (up to 150 mm cutting depth)	1,500-2,000	5,000
Planing machines (working width 510 mm)	3,000-10,000	2,000-3,000
Milling machines	4,000-6,000	2,000

Source: FGU Kronberg Unternehmensberatung.

There is one particle board plant with 30 TPD capacity and one fibre board plant with a capacity o 3,000 m^3 per annum running in 1981 at 33 per cent capacity and producing 1,000 m^3.

The Processing Industry: Future Prospects

Table VIII.7 presents output and export demand projection for logs, sawnwood and plywood for the period 1982-1990. The projections of sawnwood and plywood exports take into account the growth of overseas markets and assume a slow but steady improvement in the competitive position of Indonesian exports in terms of product quality and marketing capabilities. The expansion of plywood exports is a very important element in Indonesia's industrialization strategy combining resource based and export led growth. This requires broad based supportive measures by the Government. The government plans to establish a wood processing centre at Marunda while similar projects are planned in several key ports in Java, Sumatra, Kalimantra and Sulawesi.

Table VIII.7 Export prospects for wood products, 1982-1990
(million m^3)

	1982[a/]	1983	1984	1985	1990
Production (in million m^3)					
Logs b/	15.9	16.6	16.8	16.4	24.0
Sawnwood b/	3.8	3.9	4.2	4.4	6.0
Plywood	2.2	2.6	3.1	3.4	5.0
Export Volume (in million m^3)					
Logs	4.0	3.5	2.0	0.5	1.5
Sawnwood	1.4	1.5	1.6	1.7	2.5
Plywood	1.2	1.4	1.7	1.8	2.8
Export Values (in $ million)					
Logs	340	311	190	52	225
Sawnwood	226	254	312	374	815
Plywood c/	274	344	425	468	994
Total	840	908	927	894	2,034

a/ Estimate.
b/ Includes conifers and non-conifers.
c/ Includes veneers.
Sources: Indonesia, Policies for Growth with Lower Oil Prices, World Bank, May 12, 1983 (Report No.4279).

These projections may need to be reviewed in the light of overseas technological developments. A new fibre board process has come into operation in the United States. The new product is called medium-density fibre board (MDF).[1] It has high form stability, is simple in production based on wood chips as raw material and can be made humidity-resistant through the addition of chemical agents. Annual production is at present doubling every two years in the USA. In Indonesia an important variable which may influence future choice betweeen plywood and medium density fibre board will be the continuing availablility of adequate supplies of the kinds of tropical hardwood needed for plywood production (e.g. Meranti). This in turn will depend on effective reafforestation.

It is not possible at this stage to assess how far the estimates of investment requirements for plywood production given above would be affected; major changes in plans for new capacity in the plywood/fibre board stage of wood processing may need to be made very soon. A careful study of the situation is urgent.

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[1] For further details on the production of medium density fibreboard see: UNIDO ID/WG.335 on "Seminar on Wood Based Panels and Furniture Industries", Beijing, China, 23 March - 7 April 1981.

8.3 Equipment Production

The most important equipment for saw milling, the saws themselves, are high precision instruments which cannot be recommended for local production at this stage. Most of the log intake (other than hydraulic lifting equipment), the distribution system and the final transport and sorting system can technically be built in Indonesia. Local content can technically be of the order of 50 per cent of equipment value.

The equipment for plywood production which is technically capable of being produced in Indonesia represents about 30 per cent of the value of a plywood factory. Table VIII.8 lists the major items of equipment involved in plywood production. Assuming that plywood remains the preferred processing material and product, it should technically be possible to extend the local content gradually to about 60 per cent. Special reference should be made to driers, demand for which will come not only from the plywood industry but also from saw mills and other wood working plants. The investment cost of driers is of the order of US$ 10 per m^3 for larger capacities (50-100,000 m^3 p.a.) of which 60 per cent can technically be built domestically. The extremely difficult control equipment, which accounts for the other 40 per cent, is not at this stage suitable for local production. An analysis of the market potential for driers would be desirable.

The castings required for wood working machinery should initially continue to be imported, with a view to domestic foundry production at a later stage. Of the general purpose machine tools required, 80 per cent should be technically capable of local production.

Table VIII.8 Equipment required for plywood production

Quantity	
2	Electric chain saws
1	Log debarking machine
4	Electric hoists
	Runways for electric hoists
2	Optical centring and loading devices for logs
2	Peeling lathes
2	Complete lines for waste utilisation
1	Conveyer for rest rolls
2	Conveyers for peeling wasters
1	Chip-forming machine for wastes
2	Hanging trucks for reel transport
	Supporting framework for reeling truck
4	Floor reel stores
80	Reeling reels
5	Pneumatically controlled clippers
	Automatic clippers
2	Belt conveyers
1	Continuous dryer with cooling chambers
2	Floor belt conveyers
2	Roller dryers with cooling chambers
1	Electrohydraulic elevator
	Contact sanding machine with upper band
3	Automatic trimming clipping machines
3	Automatic clippers for peeled veneers
2	Clippers with symmetrical sections
4	Belt conveyers
2	Transversal jointing machines
4	Longitudinal splicing machines
3	Glue mixers
4	Cylinder gluers
6	Electrohydraulic elevators with roller table
2	Roller tables
4	Double roller tables
	Hydraulic cold pre-press for panels 2,440 x 1,525 mm
	Hydraulic cold pre-press for panels 3,050 x 1,525 mm
	Hot-plate presses for panels with 32 openings
11	Electrohydraulic elevators
2	Double squaring machines
1	Intermediate device between the squaring machines
5	Roller and ball tables
8	Electrohydraulic elevators with roller table
1	Contact sanding machine with lower band
2	Motorised roller tables
1	Contact sanding machine with 3 upper bands

Source: Field mission plant visit.

If medium-density fibre board (MDF) were partially to replace plywood, processing equipment requirements will be significantly different, as the following list of required equipment shows:

1. Wood manipulation
    - wood and sawmill waste transport
    - *chippers
    - tanks, structural equipment
2. Defibration
    - conveyors
    - *magnetic separators
    - *defibration machines
    - *fibre silos with charging equipment
    - fibre driers
    - dry silos
    - pneumatic conveyors
    - mechanical conveyors
3. Gluing unit
    - measuring units
    - *gluing machines
    - conveyors

The items marked * are substantially different from equipment required for plywood production. Feasibility of domestic production of such equipment would require further investigation.

The castings required for wood working machinery could initially continue to be imported, and gradually be subcontracted to other local suppliers with a view to domestic foundry production at a later stage. Of the general purpose machine tools required, 80 per cent should be technically capable of local production.

8.4 Investment Implications

Saw milling. Repelita IV targets for saw milling require an addition of at least 5.6 million m^3 new capacity to the 1983 figure of 8.1 million^3 for existing capacity. This is equivalent to 80 additional saw mills with 3 lines and an annual capacity of 70,000 m^3. At US$ 2 million for the machinery of each unit, one arrives at a total of US$ million 160 new investment over the five year period, or US$ 32 million a year. To this must be added replacement investment estimated at US$ 17-28 million (7 per cent of capacity annually, i.e. 0.6-1.0 million m^3) and US$ 23-40 million for parts and components (10 per cent of installed capacity). Total annual investment required in the saw milling industry during Repelita IV, given Repelita IV output targets, comes to US$ 72-100 million. Close monitoring will, however, be necessary to determine whether these are realistic figures.

Plywood fibre board. Expansion planned to 1985 (2.4 million m^3) will require investment in equipment, at US $200/$m^3$, of US $480 million. From 1986 to 1988 another 1.1 million m^3 capacity is planned to be installed, representing investment cost of US $220 million or US$ 73 million a year. These figures may need to be revised if plywood is partially replaced by MDF.

Some of the plywood making machinery and equipment at present in use will need to be replaced by higher quality installations. These investments are cautiously estimated at US $50 million (0.25 million m^3 at US $200/$m^3$) for the three year period 1986-88 or US$ 17 million a year. This gives the following order to magnitude for required investment:

	US $ million per year
new investment 1983-85 (US $480 m.)	160
new investments 1986-88	73
replacements 1986-88	17
production inputs and auxiliaries (US $20/$m^3$ of installed capacity)	140
spare parts (US $10 per m^3)	70
	460

For the period after 1985, this estimate suggests an annual investment requirement by the plywood fibre board industry of around US $300 million.

Wood working. Growth in the use of wood working machinery can be expected to continue its strong performance of recent years, to which improvement of electricity supply all over Indonesia is also contributing. It is assumed that average annual sales of simple machinery will double every year during Repelita IV. At the same time, demand for more versatile and complex machinery will rise. Annual sales of the machinery considered in Table VIII.6 may be estimated as follows:

		US$ million per year
Band saws	5,000 pieces p.a.	12.5
Circular table saws	5,000 pieces p.a.	10
Planing machines	3,000 pieces p.a.	19.5
Table milling machines	2,000 pieces p.a.	10
	Total	52

Some of these simpler machines may well be gradually replaced by more expensive ones. However, these figures suggest that the total market value of sales of all wood working machinery may well reach US$ 100 million per year.

Totals. Assuming that the same percentage of technically possible local content applies to new installations and replacements, the following totals for technically possible local production in the various sub-sectors of the wood processing industry result from the above estimates:

	US $ million per year
Saw milling	36-50
Plywood/fibre board	
first stage	90
second stage	135
third stage	180
Wood working machinery	65

Totals average US $200 million a year in the first stage, US $240 million in the second stage and US $290 in the third stage. Total employment generated might be some 10,000 to 12,000 persons, and the required investment in equipment producing capacity in the order of US $150 million.

8.5 Recommendations

Any investment and domestic production decisions where amounts of this magnitude are involved clearly require careful further analysis, both with reference to production equipment and to replacement components and spare parts.

For the establishment of saw mills and plywood production plants, the GEC approach already adopted in the sugar industry and recommended for edible oil and cement production commends itself. For wood working machinery, driers, components and spare parts the desirable next step is a sub-sectoral analysis leading to assessment of the technical and economic feasibility of domestic production and of the know-how requirements and sources.

Chapter IX Cement Processing Equipment

9.1 Cement production

9.1.1 Present situation

Indonesia has by far the lowest per capita cement consumption among east Asian market economies (Table IX.1). Per capita consumption in Thailand is more than three times, in the Philippines and Malaysia more than four times and in Singapore almost ten times as high as in Indonesia.

Table IX.1: Per capita cement consumption in Asia

Country	Kg. per Person
Japan	600
Singapore	580
Korea	560
Taiwan	540
Malaysia	250
The Philippines	220
Thailand	200
Indonesia	60

Source: Indocement Group.

Production of cement, however, increased very rapidly from 542,000 tons in 1969 to 6,844,000 tons in 1981-82. The provisional figure for production in 1982-83 stands at 7.7 million tons (Table IX.2).. The aim has been to achieve self-sufficiency but this has not yet been reached. While domestic production grew rapidly, imports have also risen substantially, from only 6,300 tons in 1979 to 506,526 tons in 1982. From time to time, temporary surpluses have been exported in small quantities.

Table IX.2: Production of cement in Indonesia 1978/79-1982/83
(000 tons)

Year	1978/79	1979/80	1980/81	1981/82	1982/83a/
Production	3,629	4,705	5,852	6,844	7,650

Source: Quarterly Economic Review of Indonesia, Annual supplement 1983, The Economic Intelligence Unit.

a/ Provisional.

The installed production capacity increased from 2.7 million tons in 1977 to 8.7 million in 1981 and 11.7 million in 1983. There are 8 companies with installed capacities varying from 500,000 tons per annum to 4.7 million tons in 6 factories. The plants are located mainly in Java and Sumatra (Table IX.3). Capacity utilisation varies between 65 and 75 per cent which is comparatively low for cement industry.

Table X.3: Plant installed cement capacities and location (1983)

No.	Company/plant	Location	Capacity (000 tons)
1.	P.T. Semen Padang	Padang	1,530
2.	P.T. Semen Gresik	Gresik	1,500
3.	P.T. Semen Tonasa	Tonasa	620
4.	P.T.Semen Cibinong	Cibinong	1,200
5.	Indocement Group (6 plants)	Cieureup-cibinong	4,500
6.	P.T. Semen Nusantara	Cilacap	750
7.	P.T. Semen Baturaja	Baturaja	500
8.	P.T. Semen Andalas	Banda Aceh	1,000

Source: Bina Program for Heavy Chemical Industry, Department of Industry.

Three types of cement are produced locally: ordinary portland cement; white cement (lower ferric-oxyde content); and oil-well cement class G, with accelators or retarders to cover a wide range of well depths and temperatures (production capacity of 150,000 tons per year, sufficient to cover demand). The most widely produced kind is portland cement which is ideal for all normal purposes. Planned capacity expansion is almost entirely for portland cement.

9.1.2 Future prospects

Cement consumption has been rising annually by 15 per cent. To meet this demand, and if possible to replace net imports by an export surplus, capacity expansion plans are ambitious: for 1985, 15.9 million tons and for 1987, 19.4 million tons per annum capacity. However, financial constraints have caused a readjustment of important construction projects, so that future market growth will probably be lower than in the recent past. Among various factors causing uncertainty about future prospects are cutbacks in government and state enterprise construction programmes; slowdown in the growth rate of cement production, shortage of public investment funds for new cement plants and uncertain potential. Allowing for these uncertainties, estimates of future capacity and production development are presented in Table IX.4. It should be emphasised that these figures represent at best orders of magnitude. An important development is the Government's decision to change over to coal as the main source of energy for the cement industry. The industry's demand for coal is expected to be 0.3 million tons in 1984 and 5.0 million tons in 1990.

Table IX.4: Estimated development of installed plant capacity and production of cement, 1984-1990
(million tons per year)

	1984	1985	1986	1987	1988	1989	1990
Capacity	12.3	15.9	17.4	19.4	25.5	30.5	32.0
Production	10.5	14.3	15.7	17.5	23.0	27.5	28.8

Source: Bina Program for Heavy Chemical Industry, Department of Industry.

9.2 Processing

Cement manufacture consists principally in mixing finely ground raw materials and additives (limestone, marl, clay, shale, slag, iron ore, bauxite, silica, sand) and in clinkering the mixture, dry or wet, in kilns (usually rotary) at temperatures of up to 1,450°C.

The clinker is ground after cooling with a small percentage of gypsum, which controls the setting time by acting as a retarder, to produce the finished product. The fineness of cement is defined in terms of its specific surface area, in cm^2 per gram (Blaine number) or the equivalent in other units of measurement.

Two principal processes, wet and dry, are used to make portland cement. They differ mainly in the way the raw materials are ground and mixed before being introduced into the kiln. The dry process offers various advantages, especially lower energy costs and higher plant capacities than the wet process. It has therefore almost completely replaced the traditional wet process.

In the dry process, the raw materials are dried, ground and homogenized before being fed into the rotary kiln system, either as a mixture of dry powders or as a modulised material (Lepol process).

The rotary kilns for making clinker by the dry process are either long and of large diameter, as in the wet process operation, or they are relatively short and equipped with a pre-heater system, for example, a series of cyclones in which the material is suspended in the hot exhaust gases of the kiln. The latter technology has been preferred recently as it allows higher production capacities with less weight of production equipment.

The main categories of equipment of cement factories are shown in Table IX.5. The main elements of cost are construction costs and mechanical equipment, approximately one-third each of the total investment costs. The remaining third is made up mainly of erection and commissioning and electrical equipment. The quarry equipment (almost five per cent of total investment) is, strictly speaking, to be considered under mining equipment; similarly, auxiliary installations (1.5 per cent) belong to other capital goods sectors.

Total investment costs for equipment and installation (excluding construction) of a cement factory of 500,000 tons per annum (1,500 tons per day) capacity amount to about US $100 million, for a plant of 1.5 million tons per annum capacity (4,500 tons per day) the cost is US $155 million; in other words, there are very large economies of scale. About 30 per cent of these amounts represent cost of installation and commissioning.

Table IX.5: Main categories of cement plant equipment and share in investment cost

Type of equipment	Share in investment cost (%)	
	of category	of total
Quarry equipment	100	4.6
Mechanical equipment	100	32.6
Raw material pre-crushing section	5.9	
Raw material storage	11.6	
Raw material grinding and drying section	12.0	
Raw mix silo equipment and transport system	3.2	
Kiln section	15.8	
Firing section	3.4	
Dust collecting section	4.9	
Clinker and gypsum store	14.7	
Cement grinding section and transport system	14.7	
Cement silo equipment	1.1	
Packing system and loading of bagged and bulk cement	5.7	
Grinding media	3.0	
Refractory material	2.9	
Miscellaneous: cranes, elevators, vehicle scales, connecting elements, etc.	1.1	
Electrical equipment	100	12.1
electrical supply and distribution equipment	66.7	
Control equipment	33.3	
Auxiliary installations	100	1.5
Laboratory	22.7	
Workshops	44.0	
Water system: treatment, recovery and distribution	12.1	
Factory service installations: fire brigade and first aid	21.2	
Spare parts	100	2.3
Erection and commissioning	100	13.4
Construction costs: buildings, silos, roads, etc.	100	33.5
TOTAL		100.0

9.3 Equipment production

Cement factories are highly sophisticated and technologically complex "products". The purchaser of a cement factory expects the supplier to assume all technical risks which are usually subject to severe penalty clauses in purchasing contracts. It is therefore not easy for a new supplier to match the experience and credentials of the small number of internationally known cement factory producers.

At present, steel ducting, chutes, tanks and bins are fabricated locally. They represent less than 40 per cent of total investment costs. Among the major categories of equipment listed in Table IX.5, the following have the best potential for additional local production:

- Mechanical equipment: simple and more complex sheet metal products, those produced by automatic welding and conveyor and transport systems.
- Electrical equipment: switchboards, low and medium voltage switchgears, cables, control panels, some printed circuits, lighting systems, telephone installations and some electric motors.

Some quarry equipment, auxiliary installations, erection and commissioning and construction could also be supplied locally. Some spare parts are already produced by either the workshops of the cement factories or local repair work shops. The major spare parts with potential for future local production are refractory bricks (not yet produced but subject to applications for production licences) and castings of high quality (as yet rare in Indonesia).

The assumed increase of 13.9 million tons during Repelita IV (from 11.6 million tons in 1983 to 25.5 million tons in 1988) represents an average annual increase of 2.8 million tons. Three-quarters of this projected increase is to be in plants with 1.5 million tons/year capacity, the remaining quarter in smaller plants of around 0.5 million tons/year capacity. The annual investment required would be of the order of $US 400 million.

In addition to the assumed annual investment of US $ 400 million for new cement factories, replacement investment and spare parts will be required. Table IX.6 presents estimates of annual expenditure on equipment for new factories and spare parts for the cement industry. The estimates do not include the possible start-up in Indonesia of electric motor manufacturing on a large scale or the production of heavy equipment, such as speed reducers, heavy bearings, heavy crushers, firing systems or advanced electronic and control equipment. On a long-run basis, which would require much further technical and economic analysis, additional production of some US $ 60 million in value (at present prices) may be achievable.

Table IX.6: Estimation of possible annual production value of equipment and parts for the cement industry

	Average annual production value (million US $)
A. Investment[a]	
simple sheet and structural metal works	40
major metal works and automatic welding	40
conveyors and transport systems	20
electrical distribution and telephone equipment	10
control equipment	4
refractory bricks	6
grinding balls (special casting)	4
sub-total	124
B. Spare Parts	
refractory bricks	4
grinding balls	4
steel and grey iron castings (for cyclone, mills, crushers, etc.)	8
Sub-total	16
Total	140

[a] Because of the durability of the equipment there will be hardly a replacement demand which would not be done either by the workshop of the cement plant or the original international supplies.

Much of the heavy equipment for cement factories (electric motors, speed reducers, etc.) is similar to corresponding equipment needed by other industries. The feasibility of domestic production should be considered with this fact in mind. However, local production of these items is unlikely to start before the latter years of the decade, i.e. in Repelita V. In any case, the high technology involved, and the requisite high reliability, demand cooperation with internationally known manufacturers. Such cooperation is also desirable to guarantee equipment performance.

Refractory brick production for the cement industry may be put at US $ 10 million per year. To this should be added the potential demand of other industry branches which use such bricks. The BKPM has recently received investment applications for the production of refractory bricks. Presumably their manufacture will begin in the near future.

Castings have a production potential of 16,000 tons per annum. On the basis of the Indonesian price of US $1.00 per kg, this represents an annual output worth US $ 16 million. Several decentralised and specialised foundries could be desirable, e.g. four foundries with 4,000 tons capacity each, which would serve the cement factories in their region. The investment required is about US $10 million (or US $2.5 million for each foundry) and the employment generated might be 400 new jobs.

9.4 Investment implications (N.A.)

9.5 Recommendations

The technology of cement factories, which has some sophisticated and technologically complex features, makes it difficult to develop domestic production of individual components. A subsectoral analysis is needed as the basis for specific recommendations. As in the case of the sugar industry, the best strategy is likely to be to aim at the establishment of integrated plants by joint ventures between international and Indonesian companies, on the understanding that there will be a gradual increase of local production of equipment. In cooperation with the joint venture partners, policy guidelines could be drawn up for the increase in local content, including incentives for sub-contracting of part of the equipment to domestic firms and the development of production facilities for heavy machinery and equipment. Some of these items might be included in the planning of a General Machine Shop in Surabaya. For the establishment of production facilities for electrical, electronic and control equipment, close cooperation with the existing industry is obviously desirable. The foundry project or projects should be carried out with a foreign partner with the requisite knowhow.

X. Equipment for the Textile Industry

Introductory Note

There has always been traditional small-scale and handicraft production of textiles in Indonesia, but the modern textile sector consisted until the 1960s only of medium-sized cotton weaving enterprises, mostly established during the inter-war years. A few large spinning mills were added in the decade 1955-65. The rapid development of the modern textile industry began with Repelita I, leading in the 1970s to the establishment, chiefly through Japanese investment, of large integrated textile plants. Between 1973 and 1983 yarn production increased almost tenfold and output of textile fabrics nearly sevenfold. Realised foreign investment in the textile and leather industry during the period 1967-1981 is estimated at US $ 999.1 million by 60 foreign companies (about 35 per cent of total realised foreign investment), as well as US $1,040.3 million of domestic investment (approved) for textiles. Employment in the modern textile sector was put at 229,900 persons in 1980. Side by side with the modern textile industry, there remains a large small-scale and handicraft sector for which few reliable statistics are available but which probably provides (often part-time and intermittent) employment for up to 0.5 million people.

The Indonesian textile industry faces serious adjustment problems. During the 1970's the industry expanded rapidly in response to growing domestic demand. The industry provided low quality garments and enjoyed high levels of effective production (ranging from 331 per cent for knitting and 56 per cent for spinning). The result was the emergence of a high cost textile industry which was not competitive internationally. Today the textile industry suffers from outdated equipment and overcapacity (in particular the weaving industry) owing to rapid expansion without sufficient regard to the domestic demand pattern. The main challenge for the 1980's undoubtedly lies in the encouragement of greater efficiency and improved international competitiveness.

The textile industry in Indonesia is so large and diversified that it cannot be covered in any depth in the framework of the present study. An in-depth study would need to assess market prospects at home and abroad for each of the four main sub-sectors - spinning, weaving/knitting, finishing (dyeing and printing) and garments production. It would need to examine the relevance to Indonesia of the rapid changes in modern textile technology which are going on in the world and which must have profound effects on appropriate equipment for textile plants in the next decade and beyond. Finally, it needs to concern itself with the present condition and future propects of the small-scale and handicrafts sector and its equipment requirements. None of this has been possible in the short time available for this study.

The following analysis, therefore, is even more tentative than that in the other industry studies of this report and should be read as such. It focuses primarily on two sub-sectors of the modern textile industry, yarn and fabric production, and leaves aside both the finishing industry (which may be the sector most in need of modernization) and the small-scale and handicrafts sector.

10.1. Textile Production

10.1.1 The Present Situation

Textile industry statistics have improved in recent years, but still have many deficiencies. Table X.1 presents statistics of textile production during Repelita II and III. The industry is heavily concentrated in Java, only 8 per cent of textile production being located on the other islands. Jakarta alone accounts for 15 per cent.

Table X.1: Production of cloth, weaving yarn and fibres in Indonesia

Year	Fabric (mill. m)	Weaving yarn (000 bales)	Synthetic fibres (000 tons)
1973	0.927	316	–
1975	1.017	445	8.8
1977	1.333	678	61.2
1979	1.920	998	73.0
1981	2.094	1,233	112.0
1982a/	1.709	1,370	–

Source: Department of Industry.
a/ Provisional

There are approximately 70 spinning enterprises with an installed capacity of approximately 200,000 tons. The number of spindles installed was 482,000 in 1968 and had risen to over 2 million by 1981. The Repelita III target for 1983/84 was 2.2 million spindles.

Synthetic fibre production began during the 1970s. Indonesia now produces some polyester staple fibre, nylon filament, polyester filament and texturised filament. Nylon staple fibre, rayon filament, acrylic and others are not yet produced. Rising demand for synthetic fibres has led to the establishment of several new factories in recent years. As of 1980 there were eight synthetic fibre plants in operation, six in West Java and two in Central Java. The number of texturising plants (fine weaving yarn made by twisting and thermosetting polyester and nylon filaments) rose from 5 in 1970 to 45 in 1980. Present production capacity for synthetic fibres is as follows:

	Tons/day
Nylon filament	33
Polyester filament	180
Polyester fibre	136
Rayon (under construction)	45

Weaving is by far the largest sub-sector of modern textile yarn and fabric production. In terms of technology, the weaving sub-sector falls into three categories:

(i) About 90 large weaving enterprises with 19,200 automatic looms, i.e. an average of 210 looms per enterprise;

(ii) Some 1,500 smaller enterprises using some 75,000 power looms, i.e. an average of 50 per enterprise;

(iii) About 5,000 enterprises, mainly cottage industry, which produce textile fabrics using predominantly hand looms.

In knitting, 52 large enterprises are engaged, producing in considerable part for the export market.

In garment manufacturing, there are some 65 large enterprises (150 sewing machines or more), some 200 medium-sized enterprises and an unknown number of small enterprises.

Table X.2 shows census data for employment in the textile industry in 1980. Census data (which have many deficiencies) indicate that between 1970 and 1980 total employment in the textile industry grew by 87,400 persons, i.e. by only 19 per cent, or at an annual rate of 1.75 per cent. This was well below the rate of growth of Indonesia's labour force, despite the very rapid growth of output. The main explanation is the displacement of labour in the small-scale and handicrafts sector.

Table X.2. Employment in textile industry (spinning, weaving, garment) 1980

	Unskilled	Skilled	Total
		- Number -	
Spinning	86,118	343	86,461
Weaving	108,323	167	108,490
Garment making	65,678	82	65,760
TOTAL	260,119	592	260,711

Source: Bureau of Statistics

Virtually all the raw materials and many other production inputs into the textile industry are still imported. Cotton imports (Table X.3) rose to nearly 120,000 tons by 1980. Domestic production of raw cotton amounts to only 6,000 tons a year. While there are plans to expand cotton production in the near future, Indonesia will continue to depend on imports for most of its raw cotton requirements. Rayon and synthetic fibres are also still predominantly imported. Rayon imports rose from an average of 31,000 tons per annum in 1978/79 to 40,000 tons in 1980/81. Thanks to increased local production, imports of synthetic fibres remained relatively stable at about 25,000 tons a year.

Table X.3: Cotton imports, 1975-1980

Year	Volume '000 tons	Value US $ Mill.
1975	89.4	103.2
1976	64.1	84.4
1977	65.7	101.2
1978	90.9	118.9
1979	150.5	130.0
1980	116.9	182.5

Source: Bureau of Statistics.

Considerable efforts have been made in the past decade to develop an export trade in textiles, chiefly garments but also some fabrics. In 1979, textile exports for the first time exceeded textile imports in value (Table X.4). The 1979-80 export boom was not sustained, but there are hopes that, under the stimulus of the March 1983 devaluation of the rupiah, textile exports will resume an upward trend. Under the Multi Fibre Agreement, Indonesia has been given a quota of US$ 140 million annually, a figure which has yet to be reached.

Table X.4: Imports and exports of textile fabric and garments, 1975-1980.

Year	Total Import		Total Export	
	Volume mill m	Value mill US$	Volume mill m	Value mill US$
1975	157.3	52.7	n.a	n.a.
1976	103.4	65.9	8.3	5.5
1977	117.4	57.1	8.3	5.7
1978	130.0	66.5	26.4	18.3
1979	203.7	76.2	68.1	99.3
1980	247.8	129.0	62.6	124.8

Source: Department of Industry

10.1.2 Future Prospects

Tables X.5 to X.7 show Repelita IV targets for production, export and apparent consumption of yarn, fabric and garments during 1984-88. The planned average growth rate for production of yarn is 3.4 per cent per annum, for fabric 3.8 per cent and for garments 12.4 per cent. Synthetic fibre and cotton requirements are shown in Table X.8, with a growth rate of 3.6 per cent. Almost one-half of garments production will, it is hoped, be exported. Projected exports of yarn and fabric are quite small.

Table X.5: Projected production, imports, exports and apparent consumption of yarn, 1984-1988
(000 bales)

Year	Production	Exports	Apparent Consumption
1984	1,845	3	1,842
1985	1,909	2	1,907
1986	1,966	1	1,965
1987	2,038	2	2,036
1988	2,109	3	2,107

Source: Directorate General, Multifarious Industries.

Table X.6: Projected production, imports, exports and apparent consumption of fabric, 1984-1988
(million m)

Year	Production	Exports	Apparent Consumption
1984	2,306	36	2,270
1985	2,404	64	2,340
1986	2,470	70	2,400
1987	2,556	76	2,480
1988	2,670	120	2,550

Source: Directorate General, Multifarious Industries

Table X.7: Projected production, imports, exports and apparent consumption of garments, 1984-1988
(million pieces)

Year	Production	Exports	Apparent Consumption
1984	170	47	124
1985	185	56	128
1986	209	74	134
1987	211	71	140
1988	269	124	145

Source: Directorate General, Multifarious Industries.

Table X.8: Projected requirements of rayon, polyester and cotton, 1984-1988
(000 tons)

Year	Rayon	Polyester	Cotton
1984	66	104	217
1985	69	109	223
1986	71	112	230
1987	73	116	238
1988	75	119	248

Source: Directorate General of Multifarious Industries; for cotton: Directorate General of Estates.

10.2 Processing (n.a.)

10.3 Equipment production in Indonesia

10.3.1 The present situation

There is some production of equipment, spare parts and components for the textile industry, primarily for small and medium scale enterprises. Simple looms are produced domestically, also some weaving machines. But their quality is such that little if any of it can be used in the modern sector. Textile machinery for the modern sector is imported, mainly from Japan, but also from some European countries and from the People's Republic of China.

There is some production of castings in Ceper and Yogyakarta; no data are available on output. While there is also some production in Indonesia of spare parts and components, its magnitude is difficult to gauge because much of it is sold under foreign brand names, since imported products find a more ready market. Domestic products certainly have a substantial price advantage. Indonesia weaving shafts, for example, sell for approximately US $6-10 as compared with US $10 for Chinese, US $15 for Japanese and US $20 for European products. The same applies to shuttles; domestic production sells for US $4 a piece (plastic), while the same material from the Province of Taiwan sells for US $5 and hard wooden shuttles from Japan cost US $3-6. Cutting knives for weaving machines are produced in Indonesia by cottage industries, stamped out of Swedish steel and sharpened with a sharpening and polishing machine. They sell for US $5 a piece, but their quality is not comparable to those imported from Japan (up to US $14) or Europe (up to US $20).

10.3.2 Future prospects

The rate of technological progress in textile machinery, especially the development of shuttleless weaving and more generally automated production for integrated plants, is such that the technological gap between highly industrialised and developing countries, which narrowed during the 1950s and 1960s, is again widening. The most modern equipment is so costly and employs so little labour that is is, prima facie, inappropriate for countries with Indonesia's factor proportions; yet output from these modern plants may well be price as weel as qualitative competitive with labour-intensive production from low-wage countries. The problem for industrialising developing countries, such as Indonesia, is to find the best strategy for textile equipment production in these circumstances.

One option is to focus specifically on the equipment needs of the small-scale and handicrafts sector which cannot be allowed to disappear because the livelihood of 2-3 million people depends on it and whose economic survival could be helped by mass production of good-quality cheap equipment. A second, not mutually exclusive option, is to ignore the most advanced technology as being beyond Indonesia's reach at this stage and secure equipment for the weaving industry by importing second-hand power looms from countries which are discarding them in favour of more advanced equipment. From a strictly economic point of view, such redeployment may well be the best course for the short or medium run, but it makes little appeal to planners who seek to raise the country's industrial and technological capacity in the longer run. A third option is to follow in the footsteps of the previous generation of industrialising countries, such as Brazil, India or Romania, by embarking in gradual stages on domestic production of equipment for the modern textile industry. Owing to the technological complexity of most such equipment, and the need to achieve adequate quality if the user industry is to be competitive, particularly in export markets, domestic production will require technological and possibly financial cooperation with overseas machinery producers. There is an obvious case for beginning with a few machines, starting with assembly and gradually increasing the local content.

In Indonesia, textile machinery production might well begin with assembly of cotton spinning machines including draw frames and (for the small-scale sector) hank winding machines (used to wind the yarn in the form required for dyeing). Assembly and increasingly local production of automatic conventional shuttle looms, under licencing agreements, might follow. Domestic production of other machines should be deferred to a later date when technological experience gained and development of the domestic machinery market are more likely to permit economic production.

Scope for local assembly and increasingly local production may be put at say 285 machines (US $74,000 each) or US $21 million per annum for ring spinning machines, and 200 machines (US $10,000 each) or US $2 million per annum for hank winding machines. Output of draw frames may be of the order of US $3 million a year. This gives a total of US $26 million for spinning machinery. The investment required in new capacity for assembly and gradual production is in the order of US $15-20 million. Employment creation might be put at 1,000 new jobs.

In view of what was said above about the uncertainties surrounding the future of weaving industry development, it would be inappropriate to make even the most tentative estimates of potential domestic production of weaving machinery. A detailed sub-sectoral analysis is needed.

10.4 Investment Implications (n.a.)

10.5 Recommendations

There is a prima facie case for the gradual development of local production of textile machinery in Indonesia, but any considered recommendations presuppose more thorough study of a range of complex problems than has been possible for this study.

Of the wide range of machinery required by the modern sector of the industry, ring spinning and hank winding machines probably lend themselves best to domestic manufacture, beginning with assembly and gradually increasing local content. Local production of draw frames may also be technically feasible. Any such development should enlist the knowhow and perhaps financial cooperation of established overseas machinery producers.

On all other aspects of the development of local production of textile machinery, especially for the weaving sub-sector of the modern textile industry and for the small-scale and handicrafts sector, detailed sub-sectoral studies are desirable.

Chapter XI. Conclusions and Recommendations

11.1 Aggregate estimates of technically feasible domestic production

The preceeding chapters describe in broad terms the investment, output and employment implications of local production of processing equipment which appears technically feasible. The estimates made on various assumptions yield a total potential, in this sense, as follows (Table XI.1):

(i) Total annual investment during Repelita IV in equipment for the seven processing industries excluding textiles approximately US$ 1,086 million; of this

(ii) annual technically feasible local production of processing equipment approximately US $ 510-600 million;

(iii) investment required in additional capacity for processing equipment production US $ 380-410 million;

(iv) employment generation in equipment production: 21,000-24,000 jobs.

These are very tentative estimates, subject to many uncertainties which require clarification before any firm judgements can be made. One of the most important facts to be established is the volume of effective excess or idle capacity in established processing and equipment producing industries. There are strong indications that a significant amount of equipment could be produced by increasing capacity utilisation through improved information flow between potential purchasers and suppliers and by strengthening the engineering and production management capabilities of domestic equipment producers. Such additional production would require only marginal additional investment.

Table XI.1 also indicates the wide differences in the magnitude of potential capital goods demand among the various sectors. The requirements of estate crop processing (cocoa, coffee, tea) and probably also rubber processing (where capacity utilisation, replacement and new investment demand figures could not be established) are very much smaller than those of the other sectors. By far the largest potential is represented by the wood processing sector. If massive employment creation were to be promoted by an equipment production programme, this sector, which could generate employment

Table XI.1: Tentative estimate of investment in equipment production and employment generation

Equipment Demand Sector	Annual demand for equipment by demand sector (US $ million) 1984-1989	Technically feasible annual domestic equipment production (US $ million)	Investment in equipment production capacity (US $ million)	Employment generation (thousand persons)
Coconut and palm oil	103[a/]	90	60	4,000
Rubber	–	–	–	–
Sugar	110	78	50	3,000
Cocoa, coffee, tea	7	5.6	3	250
Wood processing	450	200 (Stage I)	150	10,000
		240 (Stage II)	165	11,000
		290 (Stage III)	180	12,000
Cement				
(new investments)	400[b/]	124	100	3,000-4,000
(spare parts)	16	16	10	400

a/ Of which 90 percent for palm oil extraction

b/ On a long term basis there is an additional domestic production potential of US $30 million for heavy machinery.

in the order of 10-12,000 persons, would deserve priority. At the same time, enormous investment, technology transfer and manpower training would be needed to achieve the desired results.

In terms of employment creation potential through equipment production, wood processing is followed by edible oil (4,000), sugar (3,000), cement (2,000) and textiles (1,000). These four sectors together have about the same potential for employment generation as the wood processing sector. If Indonesia succeeded in mastering the highly complex technology for assembly and gradual production of textile machinery, employment generation in this sector might be higher than indicated. But it should once more be underlined that this task will require enormous efforts. In terms of employment, as well as overall economic growth and welfare, the net benefits would be negative if high cost and poor quality equipment imposed additional handicaps on the processing equipment using industries.

11.2 Recommendations

Table XI.2 presents a list of selected items of equipment or equipment production facilities which are recommended for further consideration for local manufacture. The list should be regarded as one of "most promising candidates", in the sense that their technical feasibility seems more assured than that of other machinery and equipment required by these industries.

While the equipment requirements of each demand sector have their own peculiarities and require specific approaches to the development of the corresponding engineering industries, there are some measures which are of a general character and more or less common to all demand sectors. The last column of Table XI.2 summarises recommendations for follow-up action which would be necessary if development of production facilities for the equipment were considered. Such follow-up action falls into six major areas:

1. Strengthening the existing equipment producers or industries with potential for the production of equipment. The field mission identified deficiencies mainly in production management (planning, preparation, execution of works and control), engineering and design, quality control, marketing and manpower capabilities. Such measures are especially recommended for producers of equipment for the edible oil extraction, cocoa, coffee, tea and wood processing industries (parts and components).

2. Promotion and implementation of the "General Engineering Contractor (GEC) approach". The processing plants for sugar, cement, edible oil refining, saw milling, plywood and fibre board manufacture are generally commissioned on a turnkey basis. The general contractor is an engineering company which normally sub-contracts part of the equipment to be installed and, if it has no production facilities of its own, all of it. Indonesia has gained valuable experience in the sugar industry where in the past a foreign general contractor has been required to co-operate in equipment production with an Indonesian firm as affiliate. The experience gained now enables the Indonesian enterprise to switch roles with the international partner and become the main contractor.

Table XI.2: Summary of recommendations

Demand sector	Equipment recommended for production	Special measures recommended	Other recommendations for follow-up action
coconut and palm oil processing	oil extraction: hammer mills, screw presses oil refining: equipment as being determined through "GEC approach"	oil refining: "GEC approach" is recommended	1) oil extraction: strengthening of existing industries through production management, engineering and design support and manpower training programmes 2) oil refining: special technical assistance to "GEC approach"
rubber		"GEC approach" recommended	1) analysis of existing enterprises to determine future equipment and spare part demand 2) feasibility study on intermediate rubber product manufacturing and equipment production for powdered rubber production 3) preliminary study of potential for powdered rubber processes
sugar	extension of local content from 60 to 70 per cent of value of equipment	continuation of "GEC approach" determination of additional equipment for local production should emanate from this approach)	special technical assistance to "GEC approach"
cocoa, coffee, tea	3 types of machinery for cocoa 6 types of machinery for coffee 10 types of machinery for tea		1) sub-sectoral analysis of equipment producers, determination of economic viability and manpower training and technology requirements of additional equipment production 2) same as No. 1 oil extraction
wood processing	dryers, parts of saw mill installation (up to 50 per cent local content) gradual increase of local content for plywood and fibre board equipment (from 30 per cent, over 45 per cent to 60 per cent) type of equipment as being determined through "GEC approach" woodworking machinery: band saws, circular saws, planing machines, milling machines	"GEC approach" recommended for saw milling, plywood and fibre board equipment	1) sub-sectoral analyses leading to the determination of feasibility of production of woodworking machinery, dryers, spare parts and components 2) special technical assistance to the "GEC approach" 3) analysis on improvement of the ratio of cut tree utilisation vs. waste wood, including build-up of additional small scale wood industries
cement	spare parts; castings, especially grinding balls equipment: type of equipment as being determined through "GEC approach"	"GEC approach" recommended	1) special technical assistance to the "GEC approach" 2) same as no. 1 of cocoa, coffee, tea.
textiles	ring spinning and hank winding machines, draw frames, possibly later: dyeing equipment, measuring, inspecting, sizing and rolling machines		1) establishment of economic viability and industrial cooperation promotion for ring spinning and hank winding machines 2) sectoral analysis to determine techno-economic feasibility of production of other textile machinery and equipment

GEC = General Engineering Contractor (see Chapter 4.5).

This GEC approach to the establishment of processing plants should be extended to the other industries mentioned above. UNIDO recommends a technical assistance programme for this purpose. A major activity of the programme, in close co-operation with the Ministry of Industry and the relevant industry associations, would be to prepare the domestic industry to participate in tenders and to determine technical and economic feasibility of domestic production and the degree of achievable local content.

3. Feasibility studies, sub-sectoral analyses and assistance in industrial planning to determine the economic, as well as technical, feasibility of domestic equipment production in the areas tentatively recommended. Feasibility studies for specific products are recommended for intermediate rubber product manufacturing and domestic equipment production for powdered rubber, and for ring spinning and hank winding machines. Sub-sectoral analyses which aim in the first instance at identifying selected products suitable for feasibility studies are recommended for the machinery and equipment required by the cocoa, coffee and tea, textiles and wood-working industries and for driers and spare parts for wood processing. Assistance in the preparation of a sectoral plan[1] for capital goods industries is recommended with a view to elaborating a supply-demand matrix which would identify products or families of products for domestic manufacturing.

4. Promotion of industrial co-operation. The level of technology involved in the production of equipment indicated for domestic production requires in many cases co-operation with a foreign know-how partner. In some cases, a joint venture approach will be more appropriate than other forms of enterprise. UNIDO recommends a specific programme to undertake the promotion of industrial technology transfer through know-how agreements and of joint ventures with appropriate foreign partners.

5. Training of manpower. While there has been a significant improvement in the pool of relatively skilled manpower in Indonesian manufacturing industry in the past twenty years the demands that would be made by an extensive programme of capital goods production would be high, large and

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[1] For further details of UNIDO's planning methodology for capital goods industry see: Manual for Planning the Development of Capital Goods Industries, UNIDO/IO.548, 21 June 1983.

novel. Any measure for the development of such industries and for technical assistance to management should be paralleled by ambitious programmes for manpower training, whether in vocational training institutions or through incentives given to managements in existing firms.

6. Regional complementation arrangements within ASEAN. Several of the industries considered in this chapter, especially rubber, timber, sugar, palm and coconut oil processing and textiles are important in other ASEAN countries as well as in Indonesia, and it is very likely that plans to develop domestic equipment production industries are going on simultaneously in several of these countries. For example Malaysia is already the World's largest exporters of rubber and palm oil processing machinery.[1] There is an obvious case for consideration, within existing ASEAN complementation arrangements, of the possibility of co-operation among industries of two or more countries so that local equipment production can reap the economies of scale to be obtained from production for a wider regional market.

The six priority areas for follow-up action outlined above may lend themselves to being considered for UNIDO technical assistance.

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[1] UNIDO: Capital goods industry in Southeast and East Asia by Associate Professor Chee Peng Lim, University of Malaysia, Kuala Lumpur, October 1983 (draft).